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"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH

THURSDAY, NOVEMBER 3, 1870

THE GOVERNMENT OF THE ROYAL SOCIETY

WE have so often maintained in these columns that Science cannot now be propelled on its onward course by the efforts of unassisted individuals only, and that the State must itself, sooner or later, put its shoulder vigorously to the wheel, that there is some danger lest we should be thought to undervalue the force of private enterprise. We, on the contrary, attach very high importance to such enterprise, which exists amongst us in England more abundantly than perhaps in any other country in the world. It exists in two forms—in that of detached individual effort, and in that of voluntarily associated bodies, the Scientific Societies. To the latter only we propose now to address ourselves.

The services that have been rendered to science by these societies infinitely surpass in kind and in amount all that has been done by means of all other agencies. By bringing together men struggling for the same goal, though often by different routes, by submitting to the arbitrament of open discussion opposite views relating to the same subject, by publishing theoretical speculations however divergent, and experimental results however discordant, and by rewarding pre-eminent services, the truth has the fairest possible chance of being elicited, and the non-scientific classes become the recipients—though often the unconscious, and therefore ungrateful, recipients—of benefits, material as well as intellectual, immeasurable in value. Sweep away what has been done for Science in England by Scientific Societies, and scarcely a trace of Science would remain. For it must not be forgotten that individual labourers, working in however isolated a manner, are largely indebted to the stores of knowledge garnered in the Proceedings of the Societies, for the very tools with which they operate.

Such being the vast importance of these bodies, their constitution and system of internal government are questions of the highest interest. We propose to confine our remarks on the present occasion to the Royal Society, the highest of all, and that which should be the pattern to all others.

In former days, election to the Royal Society was an easier matter than it is now. At present, personages of Royal blood and peers of the Realm alone have special facilities for admission. The ordinary candidates are submitted to an ordeal of considerable stringency. Virtually they are elected, though nominally only selected, by the Council, whose decisions, however, are almost invariably ratified by the Society at large. The claims to admission of each candidate are carefully and fully discussed in Council, and fifteen only are nominated by ballot each year. The number of candidates is usually about fifty. Though the Council's list of fifteen does not always give universal satisfaction, yet it must be allowed that names rarely, if ever, appear on that list whose bearers cannot point to actual scientific work performed by themselves. Such a thing as the election of a thoroughly unscientific or unintellectual man is unknown in the present day. It follows that the standard of mental power to which the Fellows of the Royal Society must, as a body, have attained, is very high. It may, indeed, be safely asserted that no corporation in the kingdom, or even in the world, can be for a moment compared for mental power with the Royal Society. So much, in briefest terms, for its constitution.

The system of internal government by which the affairs of a body like this are regulated becomes a matter of the deepest moment, not only to the Society, but to the nation and to civilisation itself.

The governing body, the Council, is composed of a President, five Vice-presidents, and twelve ordinary members. These are all honorary posts. Two ordinary Secretaries and one Foreign Secretary, members of the Council with votes, are paid, the first two 300*l.*, and the last 100*l.* per annum, out of the funds of the Society. There is also a Treasurer, a member of Council, but unpaid. An Assistant Secretary and a Librarian, not members of the Council, and of course both salaried, perform all the necessary routine duties.

The Vice-presidents and ordinary members of Council sit two years only, and then retire by rotation. They cannot be re-elected until a year has elapsed since their retirement. The Presidentship is not limited as to duration, nor are the posts of Secretary, Foreign Secretary, and Treasurer.

There is a wide-spread feeling that this form of government admits of improvement, and as the actual occupants of the posts in which an alteration is thought desirable stand deservedly very high in the estimation, not of the scientific world only, but in that of the community generally, the reform of which we are about to speak can fortunately now be discussed without personality, and without any fear of the acrimony to which, under less auspicious circumstances, such a discussion would inevitably lead.

The proposed alterations are of the very simplest kind, namely, that the tenure of office of the President should coincide with that of the rest of the Council, and that the Secretaries and Foreign Secretaries should be unpaid.

The inconveniences of the present arrangement, on which our space only admits of a few words, are, first, that however efficient, impartial, and undespotic the President and officers may be, their permanent tenure of their posts for a number of years in succession must tend to constitute them, in a Council undergoing yearly change, more or less an *imperium in imperio*. Indeed, their very efficiency and mastery of rule and precedent, in themselves most valuable attributes, aggravate, as well as generate, this tendency. The practical effect necessarily is, that the President and officers naturally and unavoidably get into the way of acting together, and of bringing before the Council matters for deliberation in somewhat of a cut and dried condition. At the opening of the Session, the new members, it is well known, are naturally diffident of expressing views adverse to those thus prepared for their acceptance by such experienced hands; and it is a common remark that it is only in his second year that a member serving on the Council for the first time usually declares his sentiments with independence and freedom. The choice, therefore, seems to lie between the experience which results from long service in the chair and secretariat, and the greater scope for deliberative activity, which limited service in those posts would afford.

In deciding between the two alternatives, the character of the Council must be considered. It contains a small selected section drawn from a large highly select body, the very *crême de la crême* of the science and intellect of the kingdom, men who, one and all, are supposed to have gained their position by the most severe intellectual discipline, and who value that position as one of great responsibility and high honour. If chance, or favouritism, or money, or rank, had any appreciable influence on their election, the case would be very different. Some dry nursing might then be not amiss. But in the actual case, a Council composed of the flower of English intellect may safely be left to deliberate with unfettered republican freedom.

Another inconvenience attending the permanent, or rather unlimited, Presidentship, is one which may be indicated without in the slightest degree applying it to the present distinguished occupant of the chair, namely, the extreme difficulty, without causing a scandal, of removing an inefficient or undesirable President.

A third inconvenience consists in the tendency towards an unduly Conservative policy, which a permanent President is liable to betray; and a fourth disadvantage is, that the particular department of Science to which the President is devoted is apt to be kept too continuously prominent. These tendencies are opposed to the vigorous progress and the wide expansion of scientific thought which it is the purpose of the Royal Society to foster.

We have but lightly touched upon the salient features of the question, which is one admitting of a vast variety of opinions, some of which, we trust, will be elicited by our remarks, for the appearance of which in these columns we feel that no apology is necessary.*

THE GEOLOGY OF THE DIAMOND FIELDS OF SOUTH AFRICA

IN the September number of the *Cape Monthly Magazine* is an interesting article on the above subject, by Dr. John Shaw, Gold Medallist in Geology at Glasgow University, from which we have made the following extracts:—

"In February 1869, I published a paper in the *Grahamstown Journal* on the geological structure of the Vaal Region along the line where diamonds were found. This was chiefly intended as a reply to Mr. Gregory's denial of the veritability of the discovery of diamonds on various grounds, mainly geological and mineralogical, after a journey of exploration in the region.

"Since that time the finds of surface diamonds have increased, the stretch of country supposed to be diamondiferous has extended, and, at the present time, systematic digging and washing for diamonds are being carried on with an enthusiasm which success alone can have created, by upwards of 1,000 white men in different parts of the Vaal Region, but principally at Klipdrift, near Poreil.

"In July of this year I made considerable observations in the Vaal Valley, which show that the rocks are chiefly trappean, metamorphic, and conglomerate in character. I detected no pure granite formation, but syenite is, however, developed extensively, and seems to be the base of the whole system of rocks at Klipdrift. A very singular rock appears in the shape of isolated boulders on the summits of the Kopjes, and especially of the celebrated Old Kopje. This I take to be graphic granite (binary granite), or what Dana would call 'granilite,' consisting solely of quartz and large crystals of felspar.

"Above the syenite is a trap conglomerate in some places, in others are amygdaloids, and protruding through these again, basalt, assuming everywhere the hexagonal structure, and arising in some places into insulated and compacted columns.

"In some of the Kopjes there are remains of stratified rocks—clay schists, sandstone, chalk (or something very like it), which are evidently the last vestiges of a vast series of sedimentary strata, which formerly covered the whole present contour, but which have gradually given way to denudation and cataclysm.

"Such is the character of the present rock system at Klipdrift, and with a few additions (mainly supercumbent) of the whole rock series of the Vaal region.

"On the summits of the Kopjes, and as a matter of course, in the crevices between the basaltic boulders, is an alluvial gravel. In this are found the diamonds, and on the surface some have been found, indicators of the wealth beneath. The pebbles of sandstone, quartzite,

* The foregoing article, received from a valued contributor, is of so much importance that we have given it this prominence without committing ourselves to an approval of the precise course proposed; we rather invite discussion.—ED.

crystalline sandstone, granite, clayslate, agate, tourmaline, iron pyrites, garnet, garnet spinel, &c., which compose this alluvium, are all roundedly polished and waterworn, and are imbedded at Klipdrift in a brownish, fatty earth.

"The question arises, Is this alluvium of recent or ancient formation? Did the majority of the pebbles exist in the form of a conglomerate, aggregated from the alluvium of a former age? Or have the Kopjes at no very late period been the bed of the river?

"It is my opinion that the water-worn gravel has been under the influences of running water prior to the last great changes which formed the present landscape. The greater number of the water-worn pebbles and boulders are of the basalt of the Kopjes. Many of them are a crystalline sandstone, others are water-worn fragments of clayslate, sandstone, &c., of the sedimentary rocks which exist in the Kopjes. The agates, tourmalines, and garnets are undoubtedly from some supercumbent conglomerate sandstone which has yielded to denudation and no longer exists at Klipdrift, and also to a considerable extent from the amygdaloidal trap everywhere prevalent. I have in my possession from the Vaal a single fragment of red sandstone containing garnets, but I have not succeeded in tracing this to its source.

"It will, therefore, be sufficiently apparent that there must have existed, at a remote geological period, a series of metamorphic and sedimentary rocks which lay above the present rock system of the region, and that, through successive disturbances and persistent denudation, these have been worn away, forming in great part the alluvial soil of the present surface. In some few spots remnants of this series still exist, as in the clay-slaty crystalline sandstone and conglomerate of Sitlacomies Valley, in the thin layers of claystone, sandstone, and micaceous sandstone of some of the Kopjes now worked for diamonds, and generally in the fragments of sedimentary rocks scattered over the surface along the whole Vaal Valley.

"I am decidedly inclined to think that the diamonds have not been washed down from some higher region. I hope to show in another article that the Free State possesses an independent diamondiferous centre, and that there no river has existed at any time, for there is no evidence of water-wearing, and the soil is not alluvial. Diamonds have been discovered two hours' distance from Potchefstroom, and all down the Vaal to its junction with the Orange River, and thence to ten hours' distance below Hope Town. This is a stretch of at least 500 miles. I believe the diamonds have come from some rock which may now have vanished, but which existed formerly throughout the whole region.

"In concluding at present, I have to make some observations on the position of the gravelly soil which is now being washed for diamonds. The old diggers are in favour of the summits of the Kopjes. They have tested this belief, or rather formed it, from their experience of the old Kopje. How can it be explained that the soil is alluvial and yet deposited far above the influences of the river? For two or three miles inland, which I investigated, there is everywhere on the heights the same deposit.

"There are certain facts which enable me to point out the geological history of these Kopjes. The summits are all basalt. This has been protruded through the amygdaloidal and conglomerate traps. At a subsequent period, however, there must have been another elevation for the blocks and columns radiate from a centre, so that the crevices are wedge-shaped, or expanding outwards to the surface. This subsequent upheaval was evidently not simultaneous throughout the whole region, but successive, and therefore the bed of the stream was changed from place to place. The present bed of the Vaal cannot be an old one, and the whole surface of the country as far as the alluvial soil extends was, at different previous times, under the wearing and breaking influence of the river. Granting, then, a series of rocks such as have been described undergoing water-wearing by the ancient Vaal, which by intermittent and successive upheavals was compelled continually to change its course, and the presence of alluvial gravel on the summits of the Kopjes far and wide is easily explained.

"In the hollows no gravel is apparent, because a thick covering of sand, the accumulation of present denudation, lies over the gravel. Diggers do not care to undertake the labour of carrying off the surface sand at present. In time this will be done, and I am convinced there will be found more diamonds than on the Kopjes And when the day comes when the bed of the stream shall be searched by deflecting the water in canals through the many flats which abound in the Valley of the Vaal, a superior diamondiferous gravel will be worked. From all I saw and for the reason I have now advanced, the present diamond digging of South Africa is only trifling in comparison to what it should and will ultimately be."

THE QUARTERLY WEATHER REPORT

Quarterly Weather Report of the Meteorological Office, with Pressure and Temperature Tables for the Year 1869. Part I. January—March, 1869.

IT is an arduous undertaking to establish and work a system which shall give us a perfectly full, trustworthy, and continuous account of the meteorology of even so small a part of the globe as the British Isles. The Meteorological Committee of the Royal Society are therefore deserving of credit in the systematic effort which they have made to establish the weather records of these isles upon a scientific foundation. Nor must we forget that our Government has been very liberal in this matter, and that a grant of 10,000*l.* a year devoted to meteorology represents a very handsome contribution from that national purse which is, alas! so often shut when it ought to be open, and so often open when it ought to be shut.

Let us now consider how far the Committee have succeeded in advancing our knowledge of British Meteorology, and in what respect, if any, they have fallen short o that which they might have been expected to accomplish. For this purpose let us divide the labours of the Committee into three heads, and consider separately their system of obtaining information, their system of discussing it, and, in the last place, their system of publication.

In the first place, and with respect to their observational system, it is hardly necessary to state that they have established seven observatories in which the various meteorological elements are registered continuously by means of photography, or that the Kew Observatory has

undertaken to examine the records from these various outlying observatories before they are sent to the central office. Nor is it necessary to detail the other steps which have from time to time been taken by the Meteorological Committee to insure instrumental and observational accuracy; for men of science have only to examine the various publications of the office to be convinced that a large amount of accuracy has been already achieved.

In addition to the observations from self-registering instruments, other records of a less complete nature come to the office in continually-increasing quantity; for, evidently, the records from only seven stations, however completely equipped, are insufficient to give us a true view of the very complicated meteorology of these isles. It is, therefore, an important duty of the chief officer of the Committee so to increase this stock of observations as to obtain in time a complete and trustworthy meteorological record. There seems reason to believe that this will ultimately be done, and it will be a great boon to meteorological science when it is accomplished.

But, if the observational system is important, the method of reducing observations is a point of equal importance. The condensed account of the quarter's weather, and of its easterly storms, by Mr. Scott, are exceedingly useful summaries, and form, as it were, the first step of the ladder which leads from facts to laws, and it is hardly necessary to state that such summaries have a practical as well as a theoretical importance.

We pass on from these to consider next the tables of averages for the year 1869, which have been given in this Quarterly Report. As far as the air-temperature and pressure are concerned, there can be no objection to tables giving average results. These are two meteorological elements of a nature sufficiently simple to render averaging desirable; and the five-day means of those elements given in page 41 form, perhaps, the best way of accomplishing this. But surely the readings of the wet-bulb thermometer do not represent any simple meteorological element! The moisture is best represented by ascertaining the mass of vapour present in a cubic foot of air, this forming its legitimate expression in terms of *mass* and *volume*, which are fundamental physical conceptions. On the other hand, the temperature of the wet bulb, while it forms the easiest and best observational method of obtaining continuous information regarding moisture, is yet in reality a very complicated joint function of the temperature of the air, of its pressure, and of the mass of vapour present in one cubic foot. To give five-day readings of the wet-bulb thermometer cannot, therefore, we think, lead to any good result.

We are just beginning to know a little about the motions of the atmosphere and its variable components, and if we wish to extend our knowledge in this direction, it seems perfectly essential that the physical meteorologist should choose proper methods of reduction. His method ought not to be one which, when accomplished, *may possibly* increase our knowledge, but one which, from its very nature, *must necessarily* do so. He ought to seek to have the same certainty which the astronomer possesses, that in treating his observations after a particular method, the results will infallibly extend his knowledge of celestial motions.

We have dwelt so long upon this part of the labours of the Meteorological Committee, that we can only briefly allude to their system of publication. The reduced graphical representations of the observatory records given at the end of the volume, while hardly enough for the wants of meteorologists, are yet extremely valuable and useful. It is impossible to say what benefit to science may not result from bringing before the public such a speaking epitome of weather, and we owe many thanks to Mr. Francis Galton, the member of the Meteorological Committee who invented the instrument which has given us these admirable plates. BALFOUR STEWART

BEET-ROOT SUGAR

On the Manufacture of Beet-Root Sugar in England and Ireland. By William Crookes, F.R.S., &c., Editor of the *Chemical News*. Illustrated with ten engravings. Pp. 290. (London: Longmans, 1870.)

THIS work is founded on a series of articles by M. Julien M. Deby, C.E., published about a year ago in the *Scientific American;* these articles have, however been very much extended, and much new matter added, in order to bring the subject down to the present date, and so increase its usefulness in assisting those who may wish to establish beet-root farms and sugar factories in this country. The experiences obtained abroad, and investigations made in England and Ireland, show that it would be quite possible to grow sugar-beets with profit in the United Kingdom. The beets might be used as fallow crop and cultivated, instead of the roots grown in such great quantities as food for cattle, since the beet-root pulp after the extraction of sugar is even more valuable for this purpose.

During the year 1867, beet-root sugar of the value of 1,600,000*l.* was imported into this country, and it would appear that this might readily have been produced here. In the first chapter we have a description of the beet, and of the qualities that can most profitably be used for sugar making; the weight of each root should not be less than 1¼lb., nor more than 2lbs.; smaller roots are frequently woody, while larger ones are watery and poor in sugar. The juice should have a specific gravity between 1·060 and 1·070, though sometimes, when very rich in sugar, it rises to 1·075 or 1·078. The percentage of sugar in the roots varies considerably, the minimum quantity given in a long list of analyses being 3·62, while the maximum is 13·47. The next number below this maximum is 13·19, and is interesting as representing the amount of sugar found in red beet manured with London sewage. Peligot obtained as much as 18 per cent. from some French beets, and some American specimens have produced 17·6 per cent. It has been found in Ireland that from 16 to 40 tons of roots may be grown on one acre, so that satisfactory results might be anticipated in that country. Chapter II. treats of the culture of the beet, the climate, kinds of soil, manure, and all the necessary directions to the agriculturist to ensure a profitable return. Chapters III. to VII. contain a detailed description of the mode of extraction of the sugar, and a very useful statement of the cost of the different pieces of apparatus required for working up 150,000lbs. of beet-root per twenty-four hours during five months, which

would be the average yield of a 500 acre farm. Chapter VIII. gives the quantity of water required in such a factory, amounting to no less than 113,190lb., or 1,882 cubic feet per hour; the expense of labour for one year at 5,190*l.*, the total annual expense being 13,980*l.*, the total receipts being estimated at 20,470*l.*, leaving a profit of 6,490*l.*, assuming that 8 per cent. of sugar is extracted from the roots. It is however probable that this percentage might be raised to 10 per cent., when the profit would be 10,090*l.* The first outlay for the establishment of the factory is calculated at 10,845*l.* Mr. Baruchson estimates the profit at 24¾ per cent. on the outlay when 6½ per cent. of sugar is produced, each additional ½ per cent. increasing the profit 7½ per cent., so that if 8 per cent. could be obtained the profit would be no less than 48 per cent. The ninth chapter describes the concreting process of Mr. Fryer as applied to the raw juice, so as to enable the refinery to be carried on during the whole year instead of only during crop time. Chapter X. is devoted to the application of the spent beet-root pulp. As far as chemical analysis indicates it will prove, when mixed with other materials, a more useful food for cattle than ordinary mangolds or even than the original roots, though it must be admitted that no comparative experiments on feeding have yet been made. The remaining five chapters describe the manufacture of spirit from beet juice, which has been found very profitable on the Continent; the sucrate of lime process which dispenses with the employment of animal charcoal; the manufacture of potash salts from the residues; Excise regulations, and Dr. Schiebler's calcimeter for the determination of the quantity of carbonate of lime in animal charcoal.

We commend this valuable work to all interested in the subject; and wish the author success in his endeavours to introduce and encourage the extensive cultivation of beet-root in this country, and thus place us on a level with our neighbours on the Continent who have so successfully carried it out.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Dr. Balfour Stewart's Opening Lecture at Owens College, Manchester

DR. BALFOUR STEWART concludes his excellent Lecture lately delivered at Owens College, Manchester, and published in your number for Oct. 20th, with a broad classification of experimental and observational work into work requiring much time and work requiring comparatively little time for its execution. This appears to me a very useful suggestion. Dr. Stewart then goes on to say that the work requiring short periods of time "may be furthered with much advantage in institutions such as Owens College." And he adds that the same objects are at present aided by the Government grant of 1,000*l.* so carefully administered by the Royal Society; but he thinks this grant might be advantageously increased. In all this I quite agree with him.

Dr. Stewart then proceeds to deal with the other class of scientific work. And here I had better quote his own words. He says:—"But when we come to experiments and observations requiring great time, the case is very different. Certain experiments, whether from the great time they require, or the great expense they demand, cannot be well performed in a College; while routine and long-continued observations, such as those connected with the various branches of cosmical physics, are of such a nature as to require a central establishment to superintend their organisation and reduction. There is thus, I think, the necessity for a central establishment of some kind, devoted to that class of experiments and observations requiring great time, great space, and great expense for their completion."

In every word of this also I agree with Dr. Stewart. But I think a few words more are wanted to tell us by whom or how these institutions should be founded and supported. I, who have had the advantage of very frequently discussing the question with my friend Dr. Stewart, infer, without any hesitation, that he considers this should devolve on the State, which, as I have often stated in public, is my own opinion. But I think it a pity that, at a time when the question is attracting in scientific circles so much attention, this should have been left to inference by one so well qualified to speak with authority, and on an occasion which afforded so excellent an opportunity of educating public opinion, on a subject which, outside scientific circles, is so little understood.

ALEX. STRANGE, Lt.-Col.

The Aurora Borealis

A PRETTY bright display of the aurora, which was witnessed here last evening, exhibited such peculiar phenomena, that although I am told that they are common accompaniments of the aurora here, a description of them may yet be new to some of your readers. The times given in the description are by estimation from the striking of town clocks; the night being dark, and the light of the aurora not sufficient to enable me to consult a watch.

At $8^h\ 25^m$ a straight double beam of faint white light extended from Altair in the west, across γ Andromedæ overhead, nearly to the E.N.E. horizon. The northern branch of the arch was the brightest, about 3° broad, and it was accompanied at a distance of 10° or 12° on the southern side by a parallel and fainter arch. I was prevented from watching the duration of this appearance and the further progress of the aurora until a few minutes after ten o'clock. At that time a few columnar streamers of white were visible in the west, one of which, very bright, extended from α Sagittæ to ζ Cygni, and was accompanied by fainter streamers from β to between γ and ϵ Cygni, and from Altair to δ Cygni. I noted their direction, and that of a few other streamers later, in opposite parts of the sky, in order to determine the position of their centre of convergence. But this was at the same time clearly shown by a patch of nebulous white light, 10° or 15° wide, from the centre of which, at β Andromedæ, and to some distance beyond its borders, faint rays spread outwards, and mixed themselves with faint streamers which rose in close array, from the north and east, towards them. While watching this small light-cloud, its light and that of the surrounding streamers became rapidly and brightly intermittent. It soon faded, and on reaching an eminence where I could command the whole northern sky from east to west, I found that all the features of the aurora were undergoing very rapid changes. Two of the many broad and bright streamers which rose in that direction at about $10^h\ 25^m$ were directed from β Ursæ minoris to γ Cephei, and from θ Aurigæ to Algol, having their bases at the former stars, and connected, apparently, by no regular fringe or arch below, but appearing at different heights between the zenith and the horizon, and occupying chiefly the north-west to north-east quarter of the sky. The full extent of the intermittent phase, of which I had before obtained only a confined and obstructed view, was now also visible. Waves of light coursed each other over the whole extent of the streamers in no very regular direction or succession, but so as to give the general impression that conflicting currents of air, chiefly from the north, blew out and carried along with them the light of the streamers towards their highest points, or from one streamer to another. Hardly more than a second was occupied by the waves in spreading from the horizon to the zenith; and in their number, appearing simultaneously, they appeared to vary from a quick succession of ripples to a single wave. This agitation of the streamers subsided at about $10^h\ 30^m$. The centre of convergence of the streamers between β and γ Andromedæ was variously marked at about this time by a faint corona, without enclosed light, or by a nebulous light-cloud composed of irregularly radiating beams. It was traversed, apparently, by the waves from the north, east, and west, as rapidly as other portions of the sky; and but little indications of the aurora were visible to the southward from this point. For

a space of about ten minutes the aurora appeared to be fading, but at about 10h 40m a bright streamer, 5° or 6° broad at its base, rose upwards from the "pointers" to above the Polar star, while the whole northern half of the sky was again covered with fainter streamers. Waves of light flashed rapidly along the principal beam, from its base to near the zenith in about one second, and at the same time drifted upwards over the other parts of the aurora in extremely vivid and rapid succession. The progress of the disturbance continued the same, and was watched for about ten minutes, during which time occasional bright streamers rose and faded, and all the beams of the aurora were equally lighted up by the flitting waves. The motion of the latter appeared to be in parallel lines rising upwards from the N.N.E. horizon, and where in that direction the bases, or brightest parts, of the streamers were arranged in a continuous succession of altitudes from near the horizon to the zenith, the waves appeared to be propagated in the most regular and unbroken manner. Tall streamers at a considerable distance east or west of the magnetic north were lighted up very rapidly from their bases to their summits, as if directly confronted throughout their whole lengths by the advancing waves. At about 10h 45m, the cloud-like apex of the aurora was somewhat nearer to γ than to β Andromedæ, and it was lighted up like the occasional tall streamers in the east and west, by almost momentary flashes of pale, phosphorescent light. The impressions of a luminous vapour, like that which floats over phosphorus, of the *ignis fatuus*, or of the disturbed surface of a phosphorescent sea, blown by the wind, were most vividly suggested by the flickering changes of brightness in portions of the auroral cloud overhead. At 10h 50m the disturbance ceased, and the streamers gradually resumed their steadiness, some appearing soon afterwards in the south-west, from between θ Pegasi and α Aquarii to α Pegasi; and others, in the south-east, across Aries and Taurus. The auroral apex was faintly visible, at this time, near γ Andromedæ. At about 11h. a third disturbance among the auroral beams occurred for a few minutes overhead. A slightly curved arch 2° or 3° broad, extending towards the east and west about 20° on each of the apex, and lancelike streamers in the east and west, which, together with the arch, were in their ordinary state invisible, were repeatedly lighted up suddenly and very brightly, and were immediately again extinguished; the light sometimes appearing in the beams and sometimes in the arch, as if it were bandied to and fro between them. The streamers in the north were at this time very faint, and those in the south-east and south-west were almost entirely hidden by clouds, which a rising wind now drove across them from the south. From 11h 8m to 11h 10m a rapid succession of horizontal waves and wavelets of light rose in parallel lines above the N.N.E. horizon, drifting, apparently, overhead towards the south. As they appeared to catch the beams, and the arch which still remained extended across the apex towards the east and west, these were suddenly lighted up, and immediately again extinguished, as before; the flickering and dancing effect of the light which they produced resembling that reflected on the clouds in the south from distant iron-smelting furnaces upon the opposite bank of the Clyde. A repetition of the flashing lights, which, I presume, must have been those described by ancient writers as *capræ saltantes*, and by mariners familiar with displays of the aurora in high latitudes as "merry-dancers," occurred again among the beams overhead between 11h 12m and 11h 14m. Soon after this, thick clouds came over from the south, and the sky very shortly afterwards became overcast.

The beams of this aurora were uniformly white, without any trace of colour. But the farthest east and western beams of a bright aurora seen here from 8h to 11h on the evening of Thursday last, the 20th inst., were of a rich crimson red, and one tall streamer of that aurora, reaching nearly to the zenith, exactly in the north, was tinged with crimson at the top. A south-west wind, accompanied by rain, succeeded that aurora on the following day. Last night a south-west gale sprang up, and there was a considerable fall of rain here this afternoon. I heard no crackling sounds during the brightest flashing of this aurora; but such sounds might very possibly be produced in Arctic regions by the cracking of ice, which great pressure, or a change of temperature in a gale of wind, would be not unlikely to occasion as a concomitant of the aurora, if, as was recently suggested by the late Admiral Fitzroy, auroral displays in these latitudes accompany, and are pretty certain indications of the existence of, very stormy weather at a distance. A. S. HERSCHEL

Andersonian University, Glasgow, Oct. 26

A WONDERFULLY fine auroral display took place last night, very far exceeding in extent and brilliancy that of the 24th ult., as seen from this place. It began to show itself soon after sundown, attained its maximum about 8 o'clock, and had not wholly disappeared at 11. At about 8 o'clock more than half the visible heavens was one sea of colour, the general ground greenish, yellow, and pale rose, with extensive shoals of deep rose in the east and west, and from the north; streaming upwards to and beyond the zenith, tongues and brushes of rosy red so deep that the sky between looked black. The spectroscope, a direct-vision one, showed four lines in the rosy portion and one in the greenish; one strong red line near the C, one strong pale yellow line near the D, one paler near the F, and one still paler beyond, with a faint continuous spectrum from about the D to beyond the F. The C line was very conspicuous and the brightest of the whole, intermediate in position and colour to the red of the lithium and the calcium, with both of which I am familiar; plainly there were two spectra superposed, for while the red portions of the aurora showed the four lines with a faint continuous spectrum, the greenish showed only one, near the D on a faint ground. Of course, no numerical accuracy was attainable with so simple an instrument, only the judgment of the eye; but the conviction was very strong that the rosy hue was owing to hydrogen, possibly resulting from decomposition by electrical discharges of the excessively attenuated watery vapour existing in the higher regions of the earth's atmosphere, which Tyndall has shown to be capable of producing the blue colour of the sky, and by the consequent loss of which the blackness of space was discernible. T. F.

St. Mary Church, Torquay, Oct. 25

SHORTLY after sunset this evening an ill-defined auroral arch was seen in the north. At about 7·45 patches of rose-coloured light were visible about the constellations Auriga, Ursa Minor, Ursa Major, &c., and at about 8 o'clock brilliant crimson rays shot up to the zenith, and the sky seemed one vast mass of fire. The auroral light was visible as far south as Cetus and Aquarius. The crimson tint passed from time to time into a greyish light.

When the most brilliant portions were examined with the spectroscope, two bright lines were visible, one a greenish-grey line situated about the middle of the spectrum, and the other a red line looking very much like the C hydrogen line.

London, Oct. 24 W. B. GIBBS

DURING the recent brilliant auroral displays (Oct. 24th and 25th), I observed four bright lines in the spectrum of the crimson beams of the corona.

1. A broad and well defined red band near C.

2. A bright white band near D (? the same as Angström's line with wave-length = 5567). I have frequently seen this line even during very faint displays; on the 25th it was visible in every part of the sky.

3. A faint and rather nebulous line, roughly estimated to be near F.

4. A very faint line about half way between 2 and 3.

The red band was absent from the spectrum of the white rays of the aurora, but the other lines were seen.

Bedford, Oct. 29 —— THOS. G. ELGER

ON the night of the 25th a most gorgeous aurora borealis was visible at North Shields. I first observed it about 6 P.M., when it formed a splendid boreal crown, of which the centre was about 25° south-east of the zenith. Rays of brilliant crimson converged to it from all directions, especially from N.E., S., and S.W. To the north the light was more of the ordinary colour. They appeared to rise from an irregular circle, extending round the whole horizon, and slightly arched in the N.W. Below this was the usual dusky cloud. When the rays, or rather sheets, of crimson were at their brightest, they were streaked with yellowish light. At times the centre of convergence was dark, at others it was occupied by luminous clouds of twisted forms, reminding me of those of some of the nebulæ. The rays seemed to have a slow motion towards the south.

About eight o'clock the crown gradually faded, and the light of the centre flickered with a tremulous motion. At 8.15 an arch shot across the sky from N.E. to S.W., passing just north of the pole star. It slowly drifted south, and at 8.30 was in the zenith. At 10 the boreal crown had reappeared, but was of the ordinary yellowish colour.

The spectrum of the red rays contained a brilliant red line,

more refrangible than Hα, in addition to those usually seen. It was situated about ·4 of the distance from C to D. If any other observer noted the position of the arch observed at 8.15 P.M., I shall be glad to be informed, in order to calculate the height.

Clementhorpe, N. Shields, Oct. 27 HENRY R. PROCTOR

ANOTHER display of aurora borealis occurred this evening. It was not to be compared in splendour with that of the night preceding, but it had some interesting and instructive features. The sky was not clear at any time, and the masses of red light, which occupied generally similar situations to those of the preceding night, were interrupted in many places by dense clouds. I observed it at about half-past six P.M., and at that time the most remarkable feature was that streamers (generally not of a red colour) radiated from every part of the north horizon accurately to a point defined very nearly by one of the stars σ Cygni or υ Cygni, which were then near the meridian. I did not see both stars, and I am therefore in doubt, as they are of equal magnitudes, which was the star nearest to the point of convergence of the streamers.

The radiations were so well marked and so accurately directed to one point, that I mentally compared them to the ribs of an expanded umbrella. This did not last long; in a few minutes fine streamers went from the N.W. horizon towards the south-east, to the east of this point, which was then covered with red light without streamers. The largest masses of red light were, as in the preceding evening, south of the zenith, and in the south-east and south-west quarters of the heavens.

Radcliffe Observatory, Oxford, Oct. 25 ROBERT MAIN

A MAGNIFICENT auroral display was visible here on the evening of the 24th, between $8^h\ 0^m$ and $8^h\ 30^m$.

The maximum of intensity must have occurred between $8^h\ 0^m$ and $8^h\ 20^m$, but, being otherwise engaged, I did not observe anything myself until $8^h\ 25^m$, when the E. and W. regions of the sky, more especially the latter, were illuminated with a crimson or reddish glow, somewhat resembling the reflection of distant conflagrations, but on neither side did this glow appear to reach the zenith by many degrees. Shortly after the time mentioned ($8^h\ 25^m$) both disappeared, after which a phosphorescent whitish light was observed nearer to and on the S.E. of the zenith. The barometer had, during the previous day or two, shown considerable variation in atmospheric pressure.

Another display was observed on the following evening (25th), which commenced about $6^h\ 0^m$ and continued visible more or less until $7^h\ 0^m$.

The first indication that I noticed was a fiery glow similar to that seen on the previous evening, but considerably higher, and almost immediately after a magnificent broad stream of light, consisting of reddish and light tints, was observed in the N.E. extending upwards for 50° or 60°.

About $6^h\ 20^m$ the whole of the northern region of the sky extending to E. and W., and about 15° S. of the zenith, was more or less illuminated, and I should say the maximum of intensity occurred at this time. The principal luminous streams and coruscations appeared between N.E. and E.N.E. appearing first in the latter direction and increasing towards the former.

On one occasion I noticed faint luminous streamers rising from different northerly directions and converging in the zenith; these, together with the coloured bands of light before mentioned, formed a magnificent and imposing spectacle.

The northern sky afterwards presented an appearance of twilight until about $10^h\ 45^m$.

During the display the barometer stood at 29·53 (corrected for temperature). Temperature of air 49°. The minimum temperature registered during the night was 42°.

Meteorological Observatory, Twickenham JOHN J. HALL

COLLINS, in his "Superstitions of the Highlands" has these lines:—

> As Boreas threw his young Aurora forth
> In the first year of the first George's reign,
> And battles raged in welkin of the North,
> They mourned in air, fell, felt rebellion slain!

The Editor (Routledge's edition) in a note states "By 'young Aurora' Collins undoubtedly means the first appearance of the Northern Lights, which happened about the year 1715; at least it is highly probable from the peculiar circumstance that no ancient writer had taken any notice of them, nor even any modern previous to the above date." Can any of your readers state whether this is correct. C. POCKLINGTON

Poole, Oct. 27

AN aurora borealis was visible at this place on the evening of the 25th inst., between the hours of 7 and 8.30 P.M. A beautiful crimson glow was first observed towards the north-east, veiling, but not hiding, the larger stars, and the Pleiades had the appearance of a wedge of pale yellow mist behind the veil. On the horizon, looking due north, was a semicircular luminous space of clear pale light, of the colour of eastern sky just before dawn, and from this there darted at intervals over the crimson glow long slender rays of yellowish light, giving an exceedingly beautiful appearance to the phenomenon. Clouds, which had been hanging about during the day, gathered over the scene towards 9 o'clock, and when they afterwards dispersed before midnight, the glow, though still perceptible, was fading away. A falling star was observed at about eight, but considerably to the south of the aurora. There had been an aurora observed on the preceding evening, but of a less striking character. The weather has been for the last ten days extremely unsettled, sirocco (S.E.) winds prevailing, and an unusual rainfall the result, accompanied sometimes by hail, and by thunder and lightning. But clear bright days occur in the intervals of these storms, when the sky is of an intense blue, against which beautiful forms of cloud mass themselves by degrees as the day goes on, and become at length the subjects of those gorgeous atmospheric effects which make the autumnal sunsets of the bay of Fiume rivals of those of Rome.

Fiume, Oct. 28 A. M. SMITH

[In addition to the letters printed above, we have received from many other correspondents interesting and valuable descriptions of the magnificent display of the aurora, which the demands of other subjects on our space alone prevent us from publishing.—ED.]

The Aurora of Sept. 24

IT may interest your readers to know that the very brilliant aurora of the 24th and 25th September last was also visible in Canada. Mr. W. B. Dawson, writing from Montreal, notices the occurrence of a very bright aurora on both nights, flashing much, and often bright crimson. It was also seen at Quebec, and attracted much attention. He observes that its appearance was simultaneous with the division of a very large spot on the sun. Its crimson colour agrees with the red hue of your other correspondents; and is somewhat remarkable, as I have often noticed, in Canada, that the red usually alternates with green in vivid displays. GEORGE M. DAWSON

Royal School of Mines

Hereditary Deformities

THE alleged instances of hereditary deformity produced by your correspondent in NATURE for Oct. 20 do not seem at all satisfactory. They may all be referred either to an hereditary disease of the part affected, as in the suppuration of the cow's horn; or to coincidence, accompanied by a slight stretch of imagination on the part of the first narrator, as in the cases of the scar on the forehead and the crooked finger.

Prof. Huxley, in his lectures on Natural History at the Royal School of Mines in 1864, after speaking of the short-legged breed of Ancon sheep, and the six-fingered Maltese, Gratio Kelleia, said that although natural malformations were thus transmitted, artificial malformations never were; and instanced the fact of the mutilation produced by circumcision never being transmitted to the offspring. This, of course, is a negative argument, but it has great weight when we consider how many thousands have undergone that mutilation without an instance of its having been inherited by their children.

Faversham, Kent, Oct. 25 WILLIAM FIELD

The Cefn Reptile and the "Times"

THE remarkable paragraph in the *Times* of the week before last relating to the discovery of "a huge beast of the lizard tribe," in a cave at Cefn near St. Asaph, implies a belief on the part of the editorial staff that such an addition to the British fauna was not impossible, and its wide circulation proves the astonishing credulity of the public:—

"In the Vale of Clwyd, at a distance of two miles from the

cathedral city of St. Asaph, are situated the Cefn Caves. It had been rumoured of late that parties visiting this place had on several occasions seen some strange animal creeping in its dark recesses, and on Saturday visitors reported having had a good view of him, and stated it was a huge beast of the lizard tribe. On the Monday following Thomas Hughes, from Rhyl, went to try to capture him. Armed with a stout stick he approached its reported lair, but not seeing it he decided to remain in ambush at the mouth of the cave, sheltered by a projecting ledge. After having thus waited an hour his patience was rewarded with success. He could hear in the far end a hum as of a hive of bees. The sound growing louder, and now apparently quite close, Hughes peeped round the ledge, and saw the monster within three yards of him. He (Hughes) sprang towards him, and dexterously wielding his stick he dealt him a well-aimed blow upon the neck just behind the head, which caused him to stagger and reel. One more blow in the abdomen finished him. Hughes carried him home in triumph, and is now making a profit out of the affair by exhibiting him at Rhyl. The monster is of the lizard tribe, as mentioned above. Only that our country is destitute of those creatures we should have said it was a young crocodile. It measures from the nose to the end of its tail exactly 4ft. 7in., the tail being rather more than half that length. Its limbs measure 12in.; the front ones have five toes; and the hind ones four; it is web-footed. Above it is black and white beneath. Its coat is mailed, quite hard, and protruding in sharp corners and angles, like the crocodile's. The head is low and flat, the mouth large and round at the end, measuring 7in. by 3in.; the teeth are numerous, but small, and bear great resemblance to those of a large codfish. There is ample scope here for naturalists to investigate the how and wherefore this strange amphibian came to be discovered in the present epoch among the hills of North Wales."

Such is the vivid account of the capture given in the *Times*, and reprinted in several local papers; and so far as I can judge by my letters, believed in by many simple-minded people. It is altogether a most impudent hoax. The man Hughes is a sweep, who purchased a reptile which happened to die in a travelling menagerie at St. Asaph, and exhibited it at Rhyl as having been caught in the Cefn Caves, until at last it became a public nuisance, and was committed to the earth. The story related in the *Times* was invented merely to make the exhibition lucrative to Hughes the sweep. Its wide circulation, which incidentally shows an astonishing ignorance of natural history, is the only excuse for my writing this letter.

W. Boyd Dawkins

MAN AND NATURAL SELECTION

THE following reply to M. Claparède's "Remarques à propos de l'ouvrage de M. Alfred Russel Wallace sur la Théorie de la Sélection Naturelle," was written some months ago, and was intended as an appendix to a French translation of my "Essays" by M. Lucien De Candolle, to be published by Reinwald, of Paris. As it is now very uncertain when the translation will appear, and as M. Claparède's critique has been highly spoken of in several English periodicals, I think it advisable that my answer to it should be no longer delayed.

In the "Archives des Sciences de la Bibliothèque Universelle," for June, 1870, M. Edouard Claparède has done me the honour to make my "Contributions to the Theory of Natural Selection" the subject of some critical remarks. To these I now propose briefly to reply.

I must premise that I do not intend to discuss here any of those difficulties which my critic finds in the theory of sexual selection, and which apply as much to Mr. Darwin's views as to my own, because, in his new work now announced, that theory will, I have no doubt, be fully developed, and be supported by a mass of facts and observations, in the absence of which further argument is useless. I proceed therefore to the objections that apply more especially to my own views.

At p. 15 of his "Remarques" M. Claparède says, "Son étude est consacrée á la coloration des oiseaux et, absorbé dans son sujet, l'auteur oublie que d'autres facteurs peuvent, aussi bien que la couleur, attirer l'attention des ennemis sur la gent ailée. Un nid couvert d'un dôme volumineux échappera tout aussi peu, grâce à ses dimensions, à l'œil d'un animal en quête de proie, que quelques plumes brillament colorées. Les gamins de nos villages en savent quelque chose, comme l'a remarqué M. le Duc d'Argyll, et ils ne réussissent que trop, à la présence d'un gros nid, à deviner l'oiseau caché et sa couvée." This objection does not seem to me very serious, because in the first place, nests, however large, generally harmonise in colour with surrounding objects, and are not so easily seen at a little distance as a bright patch of colour; and, secondly, because "gamins" are not the chief natural enemies of the feathered tribes, while hawks and falcons do not break open nests, although they do seize and devour birds.

After giving (p. 23—25) what I must allow to be a very fair abstract of my reasons for believing that Natural Selection is not the only power that has operated in the development of man, M. Claparède intimates that I have so completely abandoned my own Darwinist principles that the reader will easily refute my arguments. He therefore confines himself to certain "reflections." I regret that he did not think it necessary to do more than this, because I have as yet in vain sought from my reviewers for any other than general objections to my arguments on this subject, and am at a loss to know how they can be so easily refuted. M. Claparède's "Reflections," however, do, fortunately, take the form of arguments. He says (p. 25), "M. Wallace n'a pas reculé devant l'explication de la formation graduelle du chant de la fauvette et du rossignol par voie de selection naturelle. La chose est toute simple, bien fou serait celui qui voudrait recourir ici à l'intervention d'une Force supérieure, ami du Beau! Les fauvettes femelles et les rossignols de même sexe ont toujours accordé de préférence leur faveurs aux mâles bons chanteurs. C'était la conséquence de leur goûts musicaux et des aptitudes harmoniques de leur oreille. Malheur aux pauvres mâles à registre peu étendu ou à timbre fêlé! les douceurs de la paternité leur ont été impitoyablement refusées; ils sont morts de jalousie dans la tristesse et l'isolement. Ainsi s'ést formée la race des bons chanteurs qui peuplent nos bocages. Pourquoi n'y a-t-il pas des chanteuses? Sans doute que les oiseaux mâles ne se sont jamais souciés de la voix de leurs épouses, soit parcequ'ils n'avaient pas l'oreille juste, soit plûtot, car cela sera contradictoire, parceque leurs gouts musicaux étaient suffisament satisfaits par leurs concerts personels. Peut-être aussi les femelles n'avaient-elles point d'aptitude virtuelle au perfectionnement de la voix; peut-être avaient-elles atteint l'extrême limite de développement vocal compatible avec l'organisation d'un oiseau du sexe féminin; ou bien enfin la sélection naturelle produite sous l'influence des poursuites exercées par des ennemis de toutes sortes contre les belles couveuses, sélection favorable, selon M. Wallace, à la production de couleurs sombres, a-t-elle mystérieusement éteint même l'éclat de sa voix? Quoiqu'il en soit, il est évident pour M. Wallace que la sélection sexuelle, en d'autres termes le goût des dames fauvettes pour la musique, a amené le grand perfectionnement de la voix des virtuoses de l'autre sexe. Mais dans l'espèce humaine, la chose aurait-elle pu se passer ainsi? Le chant harmonieux et enchanteur d'une *prima donna* aurait-il pu naître et se perfectionner par voie de sélection? Le goût musicale des auditeurs pourrait-il avoir eu une influence selectrice sur ce phénomène? Jamais, au grand jamais! Seule l'intervention d'une Force supérieure a pu amener un résultat pareil, car jamais homme primitif n'a eu de goût pour la musique. M. Wallace le sait bien: il a vécu si longtemps parmi les sauvages qui ont pu le lui dire! Au contraire, les femelles fauvettes primitives et les femelles rossignols primitives, avaient déjà le goût musical longtemps avant que leurs époux eussent appris à chanter.

Comment M. Wallace le sait-il? Le lui ont-elles dit? N'importe, il le sait."

It is a pleasure to read anything so brilliant as this, but it hardly seems to touch the point of my argument. Male birds *do* sing at pairing time to the females. Mr. Darwin says in his "Origin of Species," "All those who have attended to the subject believe that there is the severest rivalry between the males of many species to attract, by singing, the females." Female birds do *not* sing. These are facts, and they perfectly accord with the theory of the perfection of song having been developed, in the *males*, by sexual selection. In man the facts are all different. Savage women have generally no *choice* as to their husbands, as has been so fully shown by Sir John Lubbock; and in the few cases where a choice is open to them, there is not a particle of evidence to show that a musical voice ever determines that choice. Still less reason is there to think that this quality determines the male savage in choosing his wife. Yet a wonderful musical organ has been developed in both sexes, of which the use to man in his struggle for existence has not yet been shown. Surely here is a difficulty which required facts and arguments for its elucidation rather than a brilliant display of wit.

Again, in reply to my arguments as to the total absence of hair from the back of man, we are told that it should be no difficulty to a person who believes that *hairy* mammals and *feathery* birds have been derived from *scaly* reptiles ("Remarques," pp. 27, 28). But surely this is not the argument of a Darwinian. For the hair and the feathers are *useful* to their several possessors, just as the scales were to their ancestral reptiles; whereas the very essence of my difficulty is, that the nudity has *not* been shown to be *useful* to man. M. Claparède thus concludes his remarks on this subject:—"Que M. Wallace soit au moins conséquent dans la question de la chute des poils. Si l'intervention d'une Force supérieure lui semble nécessaire pour épiler le dos de l'homme, qu'il sache se résoudre à la faire agir de même sur l'échine de l'éléphant, du rhinocéros, de l'hippopotame ou du cachalot." But the four mammals here mentioned are *thick-skinned* animals, one *aquatic*, one *amphibious*, the other two inhabitants of *hot* countries, lovers of *shade* and of *marshes*. Can anything be more clear than that, in all these cases, the hair was little or not at all wanted, and, owing to their habits, was very probably even injurious, and has therefore partially disappeared by means of natural selection? while the extinct mammoth and woolly rhinoceros are instances which prove that it always re-appeared when the needs of the animal required it. If the hair disappeared from the back of tropical man by the action of the same law which caused it partially to disappear from the tropical elephant, we must ask why it did not re-appear in the arctic Finns and Esquimaux, as it re-appeared in the arctic mammoth? It is rather for me to say—"Que M. Claparède soit au moins conséquent dans la question de la chute des poils."

The last point on which my critic remarks is my argument, that the brain of savage man is in advance of his needs, and therefore could not have been acquired by natural selection; and he asks, why I do not apply the same reasoning to many other cases, especially to that of the great group of birds with a complex larynx, comprising all the singing birds, yet having many species which do not sing. He says (p. 29), "Ces oiseaux possèdent dans leur larynx un organe beaucoup trop bien conformé pour l'usage qu'ils en font. Il est donc nécessaire d'admettre l'intervention d'une Force supérieure pour façonner cet appareil, inutile aux oiseaux qui le possèdent, mais calculé en vue de générations nouvelles qui, dans un avenir plus ou moins éloigné et dans des conditions déterminées apprendront à chanter. Que M. Wallace aurait-il à répondre à une semblable argumentation?" My answer is, that the cases are not parallel or similar; if they were so, I should certainly adopt the same conclusion in both. To make them logically comparable, it would be necessary to prove that all the earlier forms of the group had the vocal organs fully developed, but did not sing; or what might be held to indicate this, that at present only a few species sing, while the great mass do not. But so far from this being the case, the majority of the species of the group have musical or sonorous voices, and there is no evidence to show that the vocal apparatus was fully developed before the power of singing began to be exercised. Man, on the contrary, stands alone in the development of his brain, and M. Claparède does not rebut the evidence I have adduced to show that the brain in savage and prehistoric man was in advance of his requirements.

In concluding his remarks, M. Claparède endeavours to impale me neatly on the horns of a dilemma, as follows:—"Ou bien M. Wallace a eu raison de faire intervenir une Force supérieure pour expliquer la formation des races humaines et guider l'homme dans la voie de la civilisation, et alors il a eu tort de ne pas faire agir cette même force pour produire toutes les autres races et espèces animales ou végétales; ou bien il a eu raison d'expliquer la formation des espèces végétales et animales par la seule voie de la sélection naturelle, et alors il a eu tort de recourir à l'intervention d'une Force supéricure pour rendre compte de la formation des races humaines." These are his last words, and they seem to me to be the weakest in the whole paper, being a pure begging of the question. They assume that man presents no phenomena which differ in kind from those presented by other animals, whereas I have adduced a number of such phenomena which my critic has neither disproved nor denied. My whole argument is founded on certain facts, and on these facts only. My critic admits the facts, does not refute my arguments, yet maintains that I should give up my conclusion, because the theory of Natural Selection *must* apply equally to man and the rest of Nature, or to neither. But why must it do so? Darwin himself claims no such universality for it. He admits that even the common origin of animals and plants rests only on analogy, and that "it is immaterial whether it is accepted or not." But M. Claparède is more Darwinian than Darwin himself, and would, I presume, say that, either all animals or plants must be descended from one common ancestor or, that no two species are thus descended. I maintain, however, that man is descended from a lower animal form, but I adduce facts which go to prove that some other law or power than Natural Selection has specially modified him. If Darwin is not anti-Darwinian in admitting, as he does, the possibility that animals and plants may not have had a common ancestor, I may surely deny that I am anti-Darwinian when I show that there are certain phenomena in the case of man that cannot be wholly explained by the law of Natural Selection.

I must not conclude without thanking M. Claparède for the very flattering terms in which he has spoken of the larger portion of my work, and also for the general accuracy and fairness with which he has condensed my views and arguments in the last essay, to which he especially takes objection. A. R. WALLACE

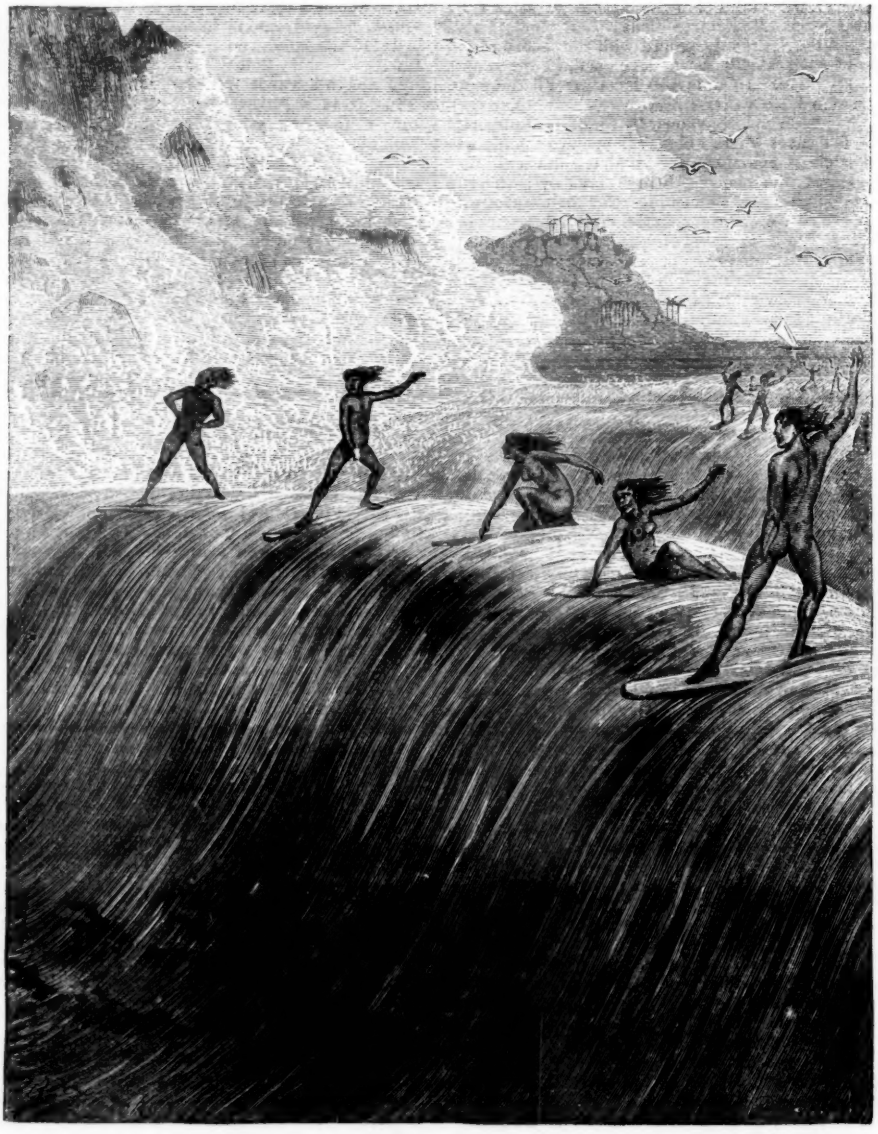
THE NATURAL HISTORY OF MAN*

IN the two handsome volumes before us is contained such a mass of interesting information concerning our less cultivated brethren as has surely never yet been collected by one writer or in one work. The first volume is occupied with Africa, that vast, and, as recent researches show, densely populated land, whose peoples present a greater variety of manners and customs and languages than any others upon the globe, and the second treats of

* "The Natural History of Man; being an Account of the Manners and Customs of the Uncivilised Races of Men." By the Rev. J. G. Wood, M.A., F.L.S., with new designs by Zwecker, Angas, Danby, Handley, &c. Engraved by the Brothers Dalziel. 2 vols 1868-70. (London: George Routledge and Sons.)

the American tribes, the inhabitants of Australia and New Zealand, with India, China, Japan, and Siam. A short notice is also given of the long-perished lake-dwellers of Switzerland.

The general plan pursued by Mr. Wood in his account of different nations is necessarily very similar. The initiatory ceremonies attendant upon entrance into manhood, marriage and death, the principal occupations and events of the life of the savage, and these, of course, form the staple of Mr. Wood's work. To do this well, however, is no slight task, considerable reading and comparison of the accounts of travellers is required, and the whole has to be worked up into the form of a continuous narrative. Mr. Wood appears to have carefully selected his authorities, and has taken only what he considers trustworthy and reliable. To give some idea of the method adopted, we may refer to his account of the Zulu Kaffirs, who he considers to have descended obtainment of food and the manufacture of the means of getting it—the bow and arrow, blow-tube and poisoned shaft, the canoe, the javelin, the club, the boomerang, or lasso; war and the requisite weapons or means of defence; dress, simple and slight as it often is; and religious observances of one kind or another, constitute, with the



SURF-SWIMMING IN THE SANDWICH ISLANDS

from the northern regions of the Continent to their present abode, and who, as is well known, are a dark-skinned but highly intelligent race. While possessing some of the characters of the negro, as the crisp, woolly hair, large wide lips, and dilated nostrils, they differ radically from him in the possession of a lofty and intellectual forehead, a more prominent nose, high cheek bones, and a nameless but decided cast of countenance. As a people, they are devoid of care, requiring no clothes, building huts of the slightest construction, and obtaining food with the greatest facility. Their reasoning powers are highly developed, and they delight in controversy. Mr. Wood then proceeds to describe the life of a Kaffir from infancy to old age, including an account of his dress, ornaments, and ceremonial observances.

To the account of the Kaffir there succeeds an equally interesting and trustworthy description of the Hottentot and of the Bosjesman or Bushman. Then follow accounts of the Korannas, the Namaquas, Bechuanas, Ovambos, and the numerous tribes of Southern and Central Africa. The facts recorded appear to have been drawn from many different sources, as Baines, Chapman, Moffat, Lichtenstein, Anderson, Burchell, Petherick, and, of course, largely from the narratives of Livingstone, Speke and Grant, Sir Samuel Baker, Du Chaillu, and Burton. The incidents selected to illustrate the character and habits of each race are, in general, very pertinent and striking, and render the whole work as amusing as it is instructive. Thus the love of finery innate in the African is well illustrated in the following story:—"An English vessel arrived at an African port, a large part of her cargo consisting of stout iron wire; nearly the whole of this was bought by the natives, and straightway vanished, no one knowing what had become of it. The mystery was soon solved.

THE LAKE-DWELLINGS OF THE ORINOCO

Suddenly the Kaffir belles appeared in new and fashionable costume. Some of them had been to towns inhabited by Europeans, and had seen certain 'cages' hung outside the drapers' shops. They inquired the use of these singular objects, and were told they were the fashionable attire of European ladies. They straightway burned to possess similar costumes, and when the vessel arrived with its cargo of wire, they bought it up, and took it home for the purpose of imitating the white ladies. Of course they had not the least idea that any other article of apparel was necessary, and so they wore none, but walked about the streets quite proud of their fashionable appearance."

The extraordinarily despotic power possessed by the chiefs of many of these tribes over the property and lives of their subjects constitutes a very remarkable chapter of their history, and is illustrated by Captain Speke's account of M'tesa, the king of the Waganda, to whom a rifle having been presented, he loaded it, and handed it to one of his pages, telling him at the same time to go and shoot somebody in the outer court. The page, a mere boy, took the rifle, went into the court, and in a moment, to Captain Speke's horror, the report of the rifle showed that the king's order had been obeyed. This barbarian was in the habit not only of flogging his wives fearfully with whips made of hippopotamus hide, but of killing them without the slightest remorse. Speke states that scarcely a day passed without some woman being led forth to execution.

In the account of the Andaman Islanders, their consummate skill in the use of the bow is described; their harpoon arrows, with which the Mincopies catch the larger fish, and which are very similar to those of Vancouver's Island, their beautiful canoes and extraordinary rowing, or rather paddling powers, beating our best crews with facility; and their family affection. To this succeeds an

account of the scarcely more civilised natives of New Guinea, with their tufted hair, active climbing habits, and curious weapons. Then follows a description of the natives of the Polynesian Islands, the Fiji with their wonderful coiffures, their ingenious manufacture of veils, fans, baskets, and canoes, their warfare and cannibalism; the Solomon Islanders and natives of New Hebrides; and after these the natives of Borneo and Sumatra, and the various American tribes.

We append an account of the surf-swimming of the Sandwich Islanders, with an illustration, as copied by Mr. Wood from the now, we fear, seldom-read "Captain Cook's Voyages," who gives the following spirited account, which will not improbably be new to many of our younger readers:—"The surf, which breaks on the coast round the bay, extends to the distance of about 150 yards from the shore, within which space the surges of the sea, accumulating from the shallowness of the water, are dashed against the beach with prodigious violence. Whenever, from stormy weather, or any extraordinary swell at sea, the impetuosity of the surf is increased to its utmost height, they choose that time for this amusement, which is performed in the following manner. Twenty or thirty of the natives, taking each a long, narrow board rounded at the ends, set out together from the shore. The first wave they meet they plunge under, and suffering it to roll over them rise again beyond it, and make the best of their way by swimming out into the sea. The second wave is encountered in the same manner as the first, the great difficulty consisting in seizing the proper moment of diving under it, which, if missed, the person is caught by the surf, and driven back again with great violence, and all his dexterity is then required to prevent himself from being dashed against the rocks. As soon as they have gained by their repeated efforts the smooth water beyond the surf, they lay themselves at length on their board, and prepare for return. As the surf consists of a number of waves of which every third is remarked to be always much larger than the others, and to flow higher on the shore, the rest breaking in the intermediate space, their first object is to place themselves on the summit of the largest surge, by which they are driven along with amazing rapidity towards the shore. If by mistake they should place themselves on one of the smaller waves which break up before they reach the land, or should not be able to keep their plank in a proper direction on the top of the swell, they are left exposed to the fury of the next, and to avoid it are obliged again to dive and regain the place from which they set out. Those who succeed in their object of reaching the shore have still the greatest danger to encounter. The coast being guarded by a chain of rocks, with here and there a small opening between them, they are obliged to steer their board through one of these, or in case of failure to quit it before they reach the rocks, and, plunging under the wave, make the best of their way back again. This is reckoned very disgraceful, and is also attended with the loss of the board, which I have often seen with great terror dashed to pieces at the very moment the islander quitted it. The boldness and address with which we saw them perform their difficult and dangerous manœuvres was altogether astonishing, and is scarcely to be credited." These swimmers used often to pass nearly a mile seaward in order to enjoy the rapid motion of their return as long as possible. Both sexes and all ranks unite in it, and even the very chiefs themselves, who have attained to the corpulency which they so much admire, join in the game of surf-swimming with the meanest of their subjects. Some of the performers acquire a wonderful amount of skill, and, not content with lying on the board, sit, kneel, and even stand upon it as they are hurled shorewards by the giant waves. The boards are of various sizes, according to the age and station of the owner. For adults they are about six feet in length. They are slightly convex on both sides and are kept very smooth, all surf-swimmers cherishing a pride in the condition of their boards, and taking care to keep them well polished and continually rubbed with cocoa-nut oil.

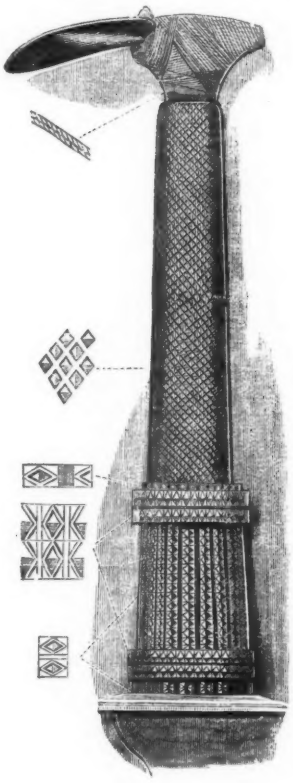
As an example of the wonderful strength exhibited by savages, the case of the Dyaks of Borneo may be cited, one of whom, while on the march with some English soldiers, exhibited it in a very unexpected manner. "The path was a terrible one, up and down steep and slippery hills, so that the Chinese coolies, who accompanied the party, first threw away their rice, and lastly sat down and wept like children. The English sergeant, a veteran accustomed to hard marching both in China and India, broke down at the first hill, and declared his inability to move another step under the load which he carried. Mr. Brooke, who was in command of the party, asked one of the Dyaks to carry the sergeant's burden, and promised him an additional piece of tobacco. The man was delighted with the proposal, and accepted it. He was already carrying food for three weeks, his whole store of clothes, one twelve-pound shot, two twelve-pound cartridges, a double barrelled gun, a hundred rounds of ball cartridge, and his own heavy sword and spear. So little, however, was he incommoded with this, that he stuffed the whole of the sergeant's kit on his back, and walked off as easily as if the whole load were but a feather weight."

The drawing on page 11 shows the lake dwellings of the tribes inhabiting the Delta of the Orinoco, as described by Humboldt in his "Personal Narrative." "The large tract of land that forms the Delta of the Orinoco (we quote from Mr. Wood) possesses some very remarkable characteristics. It is always wet, but during several months in the year it is completely inundated, the river rising to an astonishing height, and covering with water a tract nearly half as large as England. This seems to be as unpropitious a spot as could be adopted for human habitation, and yet the Waraus (or Guarános, as Humboldt spells the word) have established themselves there, and prefer it to any other locality, probably because their strange mode of life enables them to pass an existence of freedom. Varying much in the height to which it rises, in some places exceeding fifty feet, the Orinoco has the quality of rising year after year to the same height in the same place, so that when a mark is made to designate the height to which the water rose in one year, the same mark will answer year after year with scarcely the slightest deviation." Here the Itá palm thrives, which supplies to the Warau food, drink, clothing, and residence; for, selecting four that grow near each other in the form of a square, and cutting away any intervening trees, he makes deep notches in the trunks some three feet above high-water mark. In these notches are laid beams that are tightly lashed in their places by ropes made of Itá fibres. On these leaves are laid a number of cross pieces, usually composed of the gigantic stems of the leaves, then a layer of the beams themselves, and finally a smooth coating of mud, which soon dries under the tropical sun, forming a smooth, hard, and firm flooring, that will bear a fire without risk of damage to the wooden structure below. Ten or twelve feet above the floor the Warau constructs a roof of palm-leaves, the corners of which are supported by the same trees which uphold the house.

The extreme mechanical ingenuity of some uncivilised tribes, working with very imperfect implements, is perhaps nowhere better shown than in the drawing on the opposite page of an adze made by the inhabitants of Hervey Islands, and which also gives a very good idea of the excellence of the illustrations in Mr. Wood's work, and of which the following description is given:—

"The lower part of the handle is completely hollow, the native manufacturer having contrived to cut away the wood through the intervals of the upright pillars. As these intervals are not quite the third of an inch in width

the labour of removing the interior part of the handle must have been very great, and the work exceedingly tedious. Even with European tools it would have been a difficult piece of workmanship, and the difficulty is greatly enhanced by the fact that the native who carved it had nothing but a sharp stone or a shark's tooth lashed to a handle by way of a knife. The head of the adze is made of stone, and is lashed to the handle in a way exactly like that which is employed by the New Zealanders, except that it is far more elaborate. As if desirous of giving himself as much trouble as possible, the maker has employed the finest possible sinnet, not wider than packthread, and quite flat. It is laid on as regularly as if wound by machinery, and the native artist has contrived to produce the most extraordinary effects with it, throwing the various portions into a simulated perspective, and making the



THE MANGAIAN ADZE

lashing look as if there were four distinct layers one above the other."

We wish we had space to give the account of the activity of the Monkey Men of New Guinea; of the manipulative skill of the canoe-builders of Fiji, of the Zarabatana with their blow-gun, of the New Caledonian with his sling and javelin, of the extraordinary and cruel rites of the Mandans in the initiation of their youth into manhood, of the cruelty of the Tongans, and a hundred other details of interest; but our readers must refer to the work for themselves. We cannot conclude without a word of praise for the illustrations, which are extremely numerous, whilst many are original, and drawn from implements in Mr. Wood's own collection. We miss an index.

H. POWER

NOTES

IN stating that we believe that the English Eclipse Expedition is now finally arranged, it is due to the Government to add, and we do so with the greatest pleasure, that it is now quite clear that only a small part of the blame, which certainly attaches to some one, can be laid at their doors. In fact, explanations certainly are due from those who have had the management of the now famous Joint Committee. It appears that a deputation was named, and accepted the trust of representing the requirements of Science to the First Lord of the Treasury, which trust they neither fulfilled nor handed back to the Committee in order that another deputation might be appointed. We next hear of a letter written to the wrong Government department; and last of all, we are informed that the letters of the Government department—the last, we believe, written not later than the beginning of September—stating, among other things, that an application should be made in October, when the possibility of granting ships could be better discussed—have not yet been brought before the Joint Committee, which has just been summoned by the Secretary for the 4th of November, that is, to-morrow. It is not for us to censure such conduct as this, but it is our clear duty to point it out, and we hope the matter will be taken up. In spite of this mismanagement, however, we hear that the Government are prepared to aid both by money and ships when an application shall be made, and we cannot doubt that application will be made. There is still ample time to organise an expedition which shall do much good work, though perhaps it is too late to send out and erect the largest class of instruments. Large instruments, however, will be in the hands of the members of the American Government Expedition, so that this is the less to be regretted.

WE have great pleasure in announcing that Prof. Wyville Thomson, F.R.S., has been appointed by the Crown successor to Prof. Allman in the chair of Natural History in the University of Edinburgh. A vacancy is thus caused in the chair of Natural History at Queen's College, Belfast, for which we understand there are already many candidates.

THE difficulty of providing funds for the establishment of a Professorship of Physical Science in the University of Cambridge has been overcome by the colleges, at a meeting of their heads, taking upon themselves a quota of the rates for improvements and other purposes in the town of Cambridge, which was formerly charged upon the University funds. This sum amounts roughly to more than twelve hundred pounds per annum; so that the University will speedily be able to avail itself of the munificent offer of the Duke of Devonshire, and will doubtless proceed at once to establish a Professorship of Physical Science, and obtain the other aids in the way of laboratory, apparatus, and assistants, that the Professor may require.

THE following notices of lectures this term in Cambridge show that there is great increase of activity in teaching the various branches of Natural Science in that university. Professor Liveing gives a course of lectures on the "Experimental Laws of Heat," and also gives instruction in practical chemistry in the University Laboratory three days in the week. Professor Humphry gives a course on "Practical Anatomy," also a course on "Anatomy and Physiology," and connects with these a "Microscopical Demonstration" once a fortnight, and instruction in "Practical Histology" once a week. Professor Newton gives a course on "Zoology and Comparative Anatomy." Professor Willis gives a course on "Mechanics and Mechanism," and their application to "Manufacturing Processes" and the "Steam-engine." Professor Miller gives a course on "Elementary Crystallography and Weighing." Professor Sedgwick gives a course on "Geology." In Downing College, Dr. Bradbury lectures on "Comparative Anatomy," and Mr. Danby on "Geology." In Trinity, Mr.

Trotter lectures on "Electricity," Dr. Michael Foster on "Physiology," and Mr. Trotter on "Elementary Botany." In St. John's, Mr. Main lectures on "Chemistry," and gives practical instruction in the College Laboratory; and Mr. Bonney lectures on "Geology." Most of these College lectures are open to all the students of the University.

THE Natural Science Demyship of 75*l.* per annum for five years, at Magdalen College, Oxford, which was not awarded at the last examination, is announced for open competition in March next. Further particulars will be sent on application to the College.

THE splendid Physical Laboratory lately built at Oxford is opened this term for practical instruction in Physics, under the superintendence of Professor R. B. Clifton, F.R.S., assisted by two demonstrators.

A CHEMICAL society has been established at Zurich under the presidency of Dr. Wislicenus.

WE regret to have to announce the death, on October 26, of Dr. Thomas Anderson, Superintendent of the Calcutta Botanic Gardens. Dr. Anderson had greatly assisted in the establishment of the Cinchona plantations in British India, was the author of a large number of papers on botanical subjects, and at the time of his death (on sick leave in this country) was engaged, in conjunction with Dr. Hooker and Dr. Thomson, on the new Flora of India.

THE death is announced of the Rev. F. Bancks Falkner, late head-master of Appleby Grammar School, a gentleman well known from his numerous and elaborate meteorological reports and letters, which mostly appeared in the pages of the *Standard* and *Scientific Opinion*.

AT the first of the winter *soirées* to be held on Monday evening, November 14, at 8 o'clock, at 27, Harley Street, Mr. A. R. Wallace will read "An Answer to Dr. Hume, Lecky, and others, against Miracles." A discussion will be invited.

THE following officers are proposed for election by the Council of the London Mathematical Society at the general meeting to be held on Tuesday evening next:—President, W. Spottiswoode; Vice-presidents, Prof. Cayley, Prof. Henrici, Prof. H. J. S. Smith; Treasurer, Prof. Hirst; Secretaries, H. Jenkins, R. Tucker.

THE fourth opening *conversazione* of the Hackney Scientific Association took place on the 25th October, at the Meeting Rooms, New Tabernacle, Old Street Road, E.C. The objects exhibited were lent entirely by the members and some friends, and comprised an unusually fine display of microscopes of the most powerful description. Geology was well represented by a very rare collection of fossil mammalian teeth from the Freshwater Post-tertiary beds in the Lea Valley, exhibited by Mr. R. E. Olliver, also a fine series of Coal-measure fossils by Mr. W. Appleford. Astronomy was unusually well represented by numerous objects, amongst which were two refractor telescopes, exhibiting convenient forms of mounting, also numerous sketches by Mr. W. R. Birt, exhibiting the most recent progress in selenography. We must not omit to notice a numerous collection of astronomical drawings, by Mr. A. P. Holden, amongst which were four very fine sketches of the recent great sun-spot.

A NATURAL HISTORY SOCIETY was established a year ago in King Edward VI. Grammar School, Birmingham, and is now in active operation. A school collection has been commenced, with a view to a future museum.

THE Special Commissioners appointed for the purposes of the Public Schools Act, 1868, in virtue of the powers conferred upon them by that Act, have made five statutes for determining and establishing the constitution of the New Governing Bodies of the Schools of Winchester, Harrow, Rugby, Shrewsbury, and Charterhouse. These statutes have been laid before Her Majesty in Council, and are published in the *London Gazette* of Tuesday, Oct. 25. Notice is given that it is lawful for the bodies or persons authorised so to do in that Act, within two months from the date of the publication of this notification, to petition Her Majesty in Council to withhold her approval from the whole or any part of such statutes.

AS the subject of hereditary deformities is attracting some attention in our columns, it may be worth while to call attention to Brown-Séquard's experiments on epileptic guinea-pigs detailed at the recent meeting of the British Association. Dr. Brown-Séquard produced epileptic fits in the guinea-pigs either by the section of one-half of the spinal cord, or by the division of the sciatic nerve on one or both sides. During the fits it sometimes happens that the hind foot gets between the teeth, and is bitten. The animal, on recovery from the fit, tastes the blood, and if it be one in which the sciatic nerve has been divided, proceeds to nibbl off the two outer toes, which have entirely lost their sensibility from the operation on the nerve. In breeding from pairs of this kind, the offspring is without the two toes of which the parents have deprived themselves; and in these cases all the offspring become, as they grow up, perfectly epileptic; while in ordinary cases epilepsy is only rarely transmitted hereditarily. Other peculiarities existing in these epileptic guinea-pigs were also found to be transmitted to their offspring; and in dissection of the hereditarily malformed animals, a node was found on the sciatic nerve corresponding to that formed after section of the nerve in the parent.

IT may interest some readers to know that the Board of Trinity College, Dublin, have expended about 2,000*l.* in draining the College park. Situate as the park is, in the very centre of the city, its drainage will confer a considerable benefit on the city. Dublin will also be much improved by the space of ground which the College authorities are giving to the city in College Green, as well as ornamented by the new cut stone wall and handsome iron railings which take the place of the old irregular quadrangle in front of the College. The College share of the expenses amounts to 2,000*l.*

WE have received the half-yearly Report of the Marlborough College Natural History Society, from which it appears that the Society has entered on the seventh year of its existence. During these years it has undoubtedly greatly strengthened the love of Natural Science among the *alumni* of the College, an evidence of which is the publication during the last half-year of "The Birds of Marlborough" by an old member of the Society, E. F. im Thurm, a little volume for which we would wish a greatly increased circulation. The officers regret that the number of members of the Society is not yet commensurate with the number in the College who take an interest in Natural History. In no more practical way can the love of a study of nature be fostered than by the encouragement of societies similar to this.

IT is stated that the Botanical Gardens at Strasburg were used during the siege as a burying-ground.

THE twentieth part of the late Prof. Schnizlein's "Iconographia familiarum naturalium regni vegetabilis," is published under the superintendence of Dr. Eichler, of Munich. This magnificent work, commenced seven and twenty years since, is now completed in twenty parts.

AS Colombia in the last year exported about 3,500,000 lbs. of cinchona bark, valued at 87,000*l.*, the Government there naturally looks with some interest on the trade, and is desirous to improve it. It is curious to see in the official report of the Secretary of the Treasury a detailed account of the successful measures of our Government for the cultivation of cinchona in India.

AN earthquake was felt generally in the Natal colony and the Orange River Free State, about 3.45 P.M. on the 3rd August. It did no material damage. It was recorded at Bloem Fontein, in the Free State, and at Pietermaritzburg, Durban, New Guelderland, Ladismith, Noodsberg. The course appears to have been from N.W. to S.E.

THE three most recent parts of the *Bulletin* of the Imperial Academy of Sciences of St. Petersburg contain the following articles :—Quelques propriétés du fer déposé par la voie galvanique, R. Lenz ; Rapport sur un voyage entrepris dans l'intérêt de la linguistique, F. J. Wiedemann ; Remarques sur les Echinoderes, El. Metschnikoff ; Sur le poil du *Rhinoceros tichorinus*, J. F. Brandt ; Sur less congruences binômes exponentielles à base 3 et sur plusieurs nouveaux théorèmes relatifs aux résidus et aux racines primitives, V. Bouniakowsky ; Note relative à une demonstration, donnée par Cauchy, des équations générales de l'équilibre, J. Somoff ; Sur les sentences de Publilius Syrus, A. Nauck ; La Métrique pâlie Vuttodaya, J. Minayeff ; Sur l'histoire composée en arménien par Thoma Ardzrouni, X^e^ s., M. Brosset ; Sur un théorème relatif à la théorie des résidus et de son application à la démonstration de la loi de reciprocité de deux nombres premiers, V. Bouniakowsky ; Remarques et rectifications concernant l'histoire naturelle des Alcides, J. F. Brandt ; Sur le symbole de Legendre $\left(\frac{\alpha}{\rho}\right)$, V. Bouniakowsky ; Embryologie du *Phthirius pubis*. (avec une Planche.), Os. Grimm ; De l'influence de la chaleur sur l'élasticité du caoutchouk, J. Schmulewitsch ; Notice sur Ak-tau et Kara-tau, montagnes dans la presqu'île de Mangyschlak, côte orientale de la mer Caspienne, G. V. Helmersen ; Sur les dérivés de la série isocaprine, A. Borodin ; Détermination du coefficient constant de la précession au moyen d'étoiles de faible éclat, M. M. Nyrén.

A RIVAL to the far-famed Mont Cenis tunnel is announced from America. The tunnel through the Hoosac Mountain, on the Troy and Greenfield Railway, is steadily progressing, and has now overcome the great difficulties with which it started. It is 4¾ miles in length (more than half that of Mont Cenis), and of this distance about one-third is already penetrated. The work is actively proceeding night and day from both ends, and it is expected it will be finished before the expiration of the contract in 1874.

FURTHER favourable reports of ipecacuanha cultivation in India have been received. The Conservator of Forests states that the plants in the gardens at Nelamboor are doing well, and that some of the fleshy leaves were four inches long.

A UNIVERSITY FOR TEXAS

THE Rev. W. H. Sent has been for some time past in Europe, with letters from the late President of the United States, the Governor of Texas, and other distinguished Americans, as the agent of the Soule University and the Chappell Hill Female College, two literary institutions located at Chappell Hill, Washington county, in the State of Texas. His aim is so to enlarge and furnish them, especially the University, which has a medical department in Galveston, as to develop a great and permanent centre of learning and science. Considering the vastness and the resources of Texas, its position as bordering on semi-civilised regions beyond, the rapid increase of its population, which includes a large European element, and its growing commercial relations with Europe, especially with this country, such an enterprise as this must commend itself as one of great importance, and of general interest.

The degree of success that has attended the agency is, indeed, extraordinary. Mr. Sent received contributions of books, specimens, &c., from various departments of the United States Government, from Prof. Agassiz, Yale College, the Smithsonian Institution, and other eminent sources in America ; and in Europe from the Emperor, the French Government, the Jardin des Plantes, the great French authors, &c., and the same line of success was continued in Belgium, Holland, Denmark, the various German States, and elsewhere. We are glad to know that he is meeting with encouragement in London from the Admiralty, the Geological Survey, the University of London, from many of our publishing houses and other sources. The agent is applying to many of our Learned and Scientific Societies for their transactions, which will, we doubt not, be cheerfully contributed. The agency involves a patient, persevering effort to accomplish a very important work We most heartily commend the enterprise to the friends of education in this country.

Any contributions of books, or of botanical, geological, or mineralogical specimens may be sent (with a statement of the sources whence they come) to care of Messrs. Trübner and Co., 60, Paternoster Row, London, or to Messrs. Caleb Grimshaw and Co., Liverpool.

EARTH CURRENTS

IT has been my pleasure at different times to call attention to the connection that exists between the Auroræ Boreales and that great apparent rush of electricity through the crust of the earth which eagerly seizes upon the easy paths, offered to its passage by the wires of the telegraph, and by filling them with electricity, produces what are called "earth currents," or "deflections." The aurora is always accompanied by such displays, but it is rarely in England that they are of such strength as absolutely to break down telegraph communication. The earth currents of Oct. 24 and 25 have only been equalled by those which occurred in 1859.

The following extracts from the diary of one of the large telegraph stations in the South of England will be found interesting :—

Oct. 24,	5.0 P.M.	Slight deflections on all long circuits.
„	5.30 „	Gradually increasing.
„	6.0 „	Very strong ; circuits suspended for ten minutes.
„	7.0 „	Gradually decreasing.
„	8.15 „	All circuits right.
Oct. 25,	3.0 „	Deflections, which have been intermittent all day, or very strong.
„	3.30 „	Circuits nearly all stopped.
„	4.0 „	Working through on some circuits, but slow.
„	5.0 „	Deflections decreasing.
„	5.45 „	On again; all circuits suspended.
„	6.15 „	Deflections decreasing again.
„	7.0 „	Circuits clear.

This is only a sample of what occurred simultaneously all over England, and probably the globe. The currents were very irregular in their direction and very variable in their strength. Circuits running S.W. to N.E. are usually most powerfully affected, but on this occasion all directions seemed equally affected.

Where two or more wires run between two stations, the effect of these currents upon the working is easily remedied by substituting the second wire for the earth to complete the circuit. This practice was largely adopted on Monday and Tuesday last.

The most striking fact observed was that on each occasion the currents *ceased* when the auroral display *commenced*. I have not noticed this before, probably because the cessation of the one phenomenon and the first appearance of the other have scarcely ever before been so strongly indicated.

W. H. PREECE

DR. C. W. GÜMBEL ON DEEP-SEA MUD

DR. C. W. GUMBEL has recently published an important paper, containing an account of some highly interesting investigations on Deep-sea Mud. Sir R. Murchison and Professor Huxley provided him with a large quantity of mud, taken up from the Atlantic at lat. 29° 36′ 54″ N., and long. 18° 19′ 48″ W., at a depth of about 2,350 fathoms. This he first cleared, by long-continued washing, from all sea-salts soluble in water; then he divided it, by filtering, into three parts. In the first Foraminifera and larger organisms predominated; the second consisted of a sediment easily distinguished from the first, fine but heavy; the third was fine and flaky, remaining lightly suspended in water, and consisting almost exclusively of *Bathybius*, Coccoliths, Coccospheres, together with other organisms of the smallest kind (Diatoms, Radiolaria, Sponge-spicules, and a very few of the smallest Foraminifera). "Dried to about 100° C." says Dr. Gümbel, "10 per cent. of the mud consisted of large Foraminifera; 1·3 per cent. of fine, heavy mud; and 88·7 per cent. of finest *Bathybius* mud. The 10 per cent. part consisted mostly of *Globigerina*, which occurred in an astonishing variety of forms, from the smallest shapes to figures of a considerable size, and could easily be distinguished as *Gl. bulloides* and *Gl. inflata*. Next to these in number were *Orbulina universa*, *Cristellaria crepidula*, *Truncatulina lobatula*, *Discorbina rosacea*, *Rotalia soldanii*, *R. orbicularis*, *Pulvinulina elegans*; *P. micheliana*, *Nonionina umbilicata*, *Polystomella crispa*, *Lituola globigeriniiformis*, with many other (but more dismembered) species. Along with these there were individual specimens of large *Radiolaria*, Siliceous Sponge-spicules, Diatoms, shells of *Ostracoda*, torn pieces of sponge and (very rarely) of *Echinodermata*, and fragments of wood, which were very decidedly distinguishable. It is a question whether the latter was a part of the apparatus used in raising the mud. It is in the highest degree remarkable that all traces of Bryozoa, corals, and firm pieces of more highly-organised animals, were wanting, or at least were very rare.

"The fine heavier mud which composes the sediment contains, for the most part, inorganic elements, with fragments which consist essentially of carbonate of lime, and which, on being dissolved in acids, leave behind cuticular membranes and flakes, which partly gave the reaction of conchiolin. It appears to follow from this, that these pieces of calcareous matter, although I could discover by the microscope no structure in them, are essentially derived from pounded molluscous shells. The remaining portion, which was insoluble in diluted acids, was composed of irregular, for the most part lump-shaped, granules of quartz, of clearly recognisable scales of mica, of dust, and of magnetic iron, which could be drawn out by the magnetic needle; of single red, blue, and dark green transparent pieces of mineral; and of grains of crystal, of a peculiarly dark irridescent brilliance, which I can refer only to Labradorite. The polarisation and stauroscope apparatus was used for the purpose of determining these inorganic ingredients.

"These inorganic elements of the Deep-sea Mud, found at such a distance from land, appeared to me worthy of the greatest consideration. Their origin can scarcely be ascribed to the loosening of the perhaps rocky bottom of the sea, at the point where it was sounded. They rather prove that inorganic substances, which are derived from the rocky masses of the land by mechanical destruction, are conveyed by ocean currents to parts of the sea the farthest removed from land. This would render easily explicable the admixture of inorganic elements in many ocean sediments of ancient times. The explanation of clayey or marly interpositions would be made much less difficult. If heavy masses of mineral are transported so far, how much more easy would be the transportation of clayey mud which remains so lightly suspended in the water! It is almost self-evident how quantities of clay or marl may be brought to a stand at certain parts of the high sea, marked out beforehand by the direction of the ocean currents and the configuration of the bottom of the sea, and when the direction of the currents changes, may come to form even alternate strata of chalk and marl. We thus obtain a mode of explaining the formation of many marl deposits, which is at once natural and simple.

"The third portion of the Deep-sea Mud is worthy in a high degree of the interest both of the zoologist and the geologist, whilst it gives scope for many far-reaching theories. If we first analyse it microscopically, the substance, which resembles a white clay mud, resolves itself, apart from the intermingled minutest *Globigerinæ* and some few other Foraminifera, into a heap of little granules, the so-called Coccoliths (Discoliths and Cyatholiths), and of granulous flaky little lumps, the so-called *Bathybius*, compared with which all other ingredients,—the siliceous-shelled Diatoms, and *Radiolaria*, and also perhaps the so-called Coccospheres and other small organic bodies excepted,—are of very secondary importance.

"The part of the Deep-sea Mud which is made up of Diatoms and *Radiolaria*, together with Sponge spicules, is of especial importance, because it consists to no inconsiderable extent of silica, and appears to be the source from which the siliceous concretions in many chalk formations have drawn their materials. That these form no inconsiderable part of the composition of Deep-sea Mud may be clearly seen by removing the chalk by means of acids, and the organic matter by heat or by sulphuric acid. There then become visible the most beautiful forms of Diatoms, with especial frequency, *Gallionellæ*, *Coscinodisci*, and *Naviculæ*, more rarely *Actinocyoli*, *Pleurosigma*, *Rhabdonema*, *Grammatophora*, and others, of which many, concealed in the network of granulous *Bathybius* masses, were formerly scarcely visible. Many forms of extremely beautiful *Radiolaria* were also seen, together with simple Sponge-spicules. Lastly, we remark some slight fragments of plants, which may belong to the species of *Saprolegnia* and *Protococcus*."

Speaking of the Coccoliths and the *Bathybius*, Dr. Gümbel says he is in a position to confirm the conclusions of Profs. Huxley, Carpenter, and Haeckel with respect to their organic nature. In a note he adds, "I have already stated my opinion on this subject (NATURE, April 1870) but must here rectify a mistake in that communication, namely, that the organic matter of the Coccoliths yields with iodine, blue, therefore cellulose, reaction. This colouring, I am now convinced, is not the consequence of chemical action, but a phenomenon of refracted light, such as occurs with small thin leaves or membranes when greatly magnified."

After detailing some observations, microscopic and chemical, on *Bathybius* and Coccoliths, Dr. Gümbel proceeds to speak of the further distribution of the latter. "First," he says, "on looking through the Algæ, Hydrozoa, Polyps, Corals, &c., which occur on shallow sea-coasts, such as may easily be met with in every botanical and zoological collection, I succeeded in numerous instances in finding Coccoliths in the places where they had grown, and not seldom, *Bathybius* at the same time. These investigations were extended to points on the coasts of almost all seas, and now, instead of the statement lately made that the organisms in question thrive only at a depth of 5,000 feet, I am in a position to assert on a proved fact, that Coccoliths (*Bathybius*) occur *in all seas and at all depths*. This deprives these minute bodies of a certain air of wonder with which they were surrounded, as the offspring of the profoundest and most secret depths of the ocean; but by their astonishingly wide distribution and their vast numbers, which stamp them as one of the most essential members of rock-forming substances, they gain infinitely in scientific interest."

Dr. Gümbel maintains that the distribution of Coccoliths in time is not less remarkable than the present distribution in space. There is proof, he says, that they are to be found in "almost all sedimentary formations." Referring to their distribution in various formations, he says:—"But besides the Coccoliths another ingredient demands attention. In the case of the chalk of Meudon, rich in Coccoliths, if the carbonate of lime be removed by means of diluted acids, there remains a flaky and cuticular residue, in which are found thin, transparent flakes, full of the smallest granules, and resembling *Bathybius* in a high degree. . . . . This places their organic nature beyond question, and firmly establishes their relationship with the *Bathybius*. The imperishableness of this substance is indeed very remarkable." After stating that the Coccoliths occur in all the soft marls and limestones of the Jurassic and Liassic formations—"The Muschelkalk," continues Dr. Gümbel, "appeared for a long time to be proof against every experiment. Every specimen of marl which I examined was apparently free from Coccoliths. At last I had the good fortune to discover traces of them in a somewhat impure piece of rock-salt from Wilhelmsglück. Even here they show themselves extremely sparingly, but in the company of flakes, which are not unlike *Bathybius*. To the present time I have in vain examined the similar rock-salts of Berchtesgaden and Stassfurt; and as yet indications of Coccoliths in the Permian formation and the Coal-measures are wanting. On the other hand, the soft marls of the mountain limestone of Regnitzlosau, the soft marls of the Conodont strata of the Baltic provinces, the Trenton marl of New York, and even the siliceous limestone of the Potsdam sandstone, contain some traces, although to an extremely small extent.

"These facts all point to the conclusion that in the majority of calcareous marine deposits, the Coccoliths originally formed a more or less essential part of the calcareous masses, and that in thick or granulous, and particularly ancient limestone rocks, they can no longer be perceived, either on account of the opaque character of the rocks, or because they have been made by some change wholly or in part unrecognisable, or have been altogether destroyed. I have been able by some experiments to throw further light upon this subject. That these smallest organic bodies can be recognised in hard limestones only in the rarest cases, even when it contains them in great numbers, I convinced myself by means of thin slices, which I made from Deep-sea Mud, thoroughly dried and rendered hard by repeated soaking in diluted Canada balsam and by heating, and also from writing chalk, made hard in the same way, and rich in Coccoliths The infinite numbers of finest granules and rings are so massed together, one over the other, that it must be regarded as an extremely rare case when a Coccolith is clearly seen here and there at the very thinnest edges."

THE BRITISH ASSOCIATION

SECTIONAL PROCEEDINGS

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE

On a new Electro-Magnetic Anemometer and the Mode of Using it in Registering the Velocity and Pressure of the Wind.—Mr. J. J. Hall. The anemometer consists of two parts, viz.—velocity apparatus and registering apparatus. The first consists of a set of Robinson's hemispherical cups, which communicate their motion downwards into a brass box, where it is reduced in angular velocity, and causes a contact disc or *commutator* (in which two platinum contact pins are fixed equidistant from one another) to revolve in $\frac{1}{10}$th mile. An insulated metallic lever, having a platinum working face, stands on either side of the disc, so that upon the completion of every $\frac{1}{100}$th mile one or other of the contact pins comes in contact with the two levers, thus uniting them and completing the circuit. The levers are raised a few degrees and then fall back to their normal position ready to be taken up by the next pin, and so on. The recording apparatus consists of a train of wheels and pinions working in a frame or between two brass plates, the arbors of which project through a dial-plate whereon the circles and figures are engraved and carry the hands. These wheels are driven by a weight attached to a line wound round a barrel, and a locking-pin disc (the pinion of which works in the first wheel) is released at every contact of the cup-apparatus by an electro-magnet which unlocks the pin-disc and allows the first hand to advance $\frac{1}{500}$th mile on the graduated dial by a jump similar to the minute hands in remontoire clocks. By turning on a "strike-silent" stop a hammer lever is brought into connection with the escapement and strikes a bell at every contact. By this arrangement the observer has nothing to do but to notice the seconds-hand of his watch or chronometer while he counts the number of times that the bell is struck, each of which corresponds to the five-hundredth part of a mile, and by a formula arranged (and exhibited) by Mr. Hall (who has also arranged a comprehensive series of tables for use with this instrument) the hourly velocity may be readily deduced. In noting velocities extending over long periods of time, the instrument is read in the same manner as the ordinary cup and dial anemometer, or as a gas meter. By means of the formula before mentioned (although the unit of measurement in this instrument is five-hundredths) the observer may arrive at results as near the truth as if the instrument were capable of registering the one-thousandth part of a mile, while the great advantage lies in the fact that the battery power is less called into action, from which we may infer its elemental duration will be considerably longer.

A Magnetic Paradox.—Mr. S. Alfred Varley, Assoc. Inst. C.E. The author stated he had termed the instrument a Magnetic Paradox because the phenomenon exhibited by it was the apparent repulsion of soft iron by a magnet. The apparatus consisted of a compound magnet in a box, and when pieces of soft iron were placed on the box over the poles they became magnetic by induction and were attracted by the magnet; but if a soft iron bar not by itself magnetic was approached near to the pieces of iron, they leapt away from the magnet in the box and became strongly attached to the soft iron bar, the pieces of iron appearing to be repelled by the magnet and attracted by the iron bar. The author stated the explanation demonstrated the duality of the magnetic force, and it would also prove, did we not already know it, that magnetic force was transmitted only by induction. He stated that if a piece of soft iron were placed over the poles of a magnet, the magnet developes the magnetic forces resident in the iron by separating them, and the iron is attracted only by virtue of the forces existing in the iron itself, and to the extent to which the forces are separated. If the magnet be bent, bringing the lower pole round and over the piece of soft iron, the magnetic forces resident in the soft iron will be more developed: but if the piece of soft iron be midway, it will not be attracted, as the forces on either side are equal and balance; another attraction will, however, be manifested if one pole be nearer to the piece of iron than the other. If, instead of bending the magnet as just described, the piece of soft iron placed over the magnet be approached by a soft iron bar, the magnetic forces separated and rendered active in the piece of iron will develop the magnetic forces resident in the iron bar, and if the bar opposed no resistance to the assumption of the magnetic condition, it would exert an attractive force for the piece of soft iron equal to that exerted by the magnet, provided always that the bar was at the same distance. It was stated that as the mass of iron in the iron bar was much greater than that of the piece of soft iron, the resistance opposed by the bar to polarisation was comparatively small, and might be disregarded, and consequently it followed that as the dual forces resident in iron are equal, and the one force cannot be developed without equally developing the other; when the iron bar was approached nearer to the piece of soft iron it became attracted, leaping away from the magnet and attaching itself to the iron bar, and this notwithstanding that the attractive force exhibited by the iron bar has been called into being by the magnet in the box, which is nearer to the piece of soft iron than it is to the iron bar. The iron bar also collected the magnetic rays of force issuing from the magnets, and consequently it exerted a greater attraction for the piece of soft iron than any individual magnet forming part of the compound magnet. This was shown by placing a piece of soft iron on the pole of one of the magnets and removing it from the pole by the superior attractive force of the iron bar. It was also shown that if only the thickness of a piece of writing-paper were placed between the magnets and the piece of soft iron, the appearance of repulsion could be prevented.

SECTION B.—CHEMICAL SCIENCE

On the Separation from Iron Furnace Cinder of Phosphoric Acid for Manurial Purposes.—Mr. James Hargreaves. While the author was engaged in an attempt to produce a good serviceable steel direct from phosphoric pig-iron, by the use of nitrate of soda, the fact forced itself upon his attention that phosphorus had previously been too much looked upon as something to be *got rid of*, and not sufficiently as something to be *got hold of*; and that to effect the latter would be the best means of effecting the former. When phosphoric pig-iron is converted into malleable iron, the phosphorus is, in great part, transferred to the refinery and puddling furnace cinder in the form of phosphate of iron, the amount varying with the composition of the pig-iron which yields it. The refining and puddling furnace cinder from Cleveland pig-iron generally contains from 3 to 7 per cent. of phosphoric acid, which is from one-fourth to one-half the amount contained in good commercial soluble phosphate of lime. This cinder is sometimes again used for the manufacture of pig-iron, but the product is of small commercial value on account of the accumulation of phosphorus in it. The concentration of the phosphorus from the pig-iron into the cinder in the form of phosphate of iron renders it more easy and practicable to separate, when the preparation of compounds of phosphoric acid is the object in view, as there is a smaller bulk of material to be treated to obtain a given amount of this product. The phosphoric acid may be separated either in the form of soluble superphosphates of lime and magnesia, or of the alkaline tribasic phosphates.

On the Retention of Organic Nitrogen by Charcoal.—Mr. Edward C. C. Stanford, F.C.S. In this paper the author submitted some incomplete researches, as a first instalment of what promises to be a wide field of inquiry, viz., the action of charcoal on organic nitrogenous matter. He was desirous of knowing whether or not a loss of nitrogen occurs when that form of matter remains in contact with charcoal, and if so, what becomes of it. If any loss occurs, it would invalidate the process recommended by the author at the Exeter meeting of the Association, viz., that of using charcoal as a means of securing the

whole value of town excreta. He said that he had shown last year that, with either fluid or solid excreta, there was no loss, as far as his experiments had then extended; and he had pointed out, also, that he expected no loss from oxidation, as both must already be regarded as oxidised compounds. His experiments since had extended over a long period, and he had included meat as one of the nitrogenous matters used; in all, however, he had found no loss of nitrogen, no oxidation, and no formation of nitrates.

Section C.—Geology

On a Census of the Marine Invertebrated Fauna of the Lias.—Mr. R. Tate. The author gave an analysis of the fossils, but desiderated more precise data before exact results could be obtained.

On the Formation of Boulder Clays and Alternations of Level of Land and Water.—Rev. J. Gunn. The author illustrated his own opinions, which were completely at variance with the generally accepted interpretation of the origin of these beds.

On Some Cases of the Recent Conversion of Glacial Drifts into what Appears to be Middle Drift.—Mr. G. J. Stoney.

On the Occurrence of Pebbles and Boulders of Granite in Schistose Rocks in Islay, Scotland.—Mr. J. Thomson. The author described the different rocks exhibited in a section across Islay from west to east, and the position of the metamorphic rock in which the boulders occurred which underlies a bed of quartzite seventy feet thick. Specimens of some of the smaller boulders with their interesting matrix still attached to them were exhibited. The bed probably indicated one of those recurring glacial epochs which had formed the subject of Mr. Wallace's communication to the section.

Diamonds of South Africa.—Professor Tennant.

Changes of Climate.—Mr. R. A. Peacock. These were due, according to the author, to rain and rivers, to denudations, to risings and sinkings of land, and to the great range of temperature in interplanetary space and on the various parts of the earth's surface. The warm, genial climate of the Carboniferous period he ascribed to the absence of high hills at that time on the globe.

Sur le terrain Silurien du centre de la Belgique.—Professor Malaise. The author described the series of beds with their fossil remains, and considered that they represented a portion of the Middle Silurians, more extensively developed in Belgium than in Britain.

On the Remains of an Insect discovered in the Carboniferous beds at Huyton.—Mr Clementshaw exhibited the specimen of the insect, and pointed out the characters upon which he ventured to refer it to the *Fulgoridæ*.

Notes on a Merionethshire Gold Quartz Crystal, and some Gold found recently in the River Mawddach.—Mr. T. A. Readwin.

Section D.—Biology

Department of Anatomy and Physiology

On the Connection of the Hyoid Arch with the Cranium.—Prof. W. H. Flower, F.R.S. In the sheep, as is well known, the anterior arch or cornu of the hyoidean apparatus is described as consisting of three bones, of which the uppermost is by far the largest and most important, and has received the name of stylo-hyal. This bone is long, compressed, and at the proximal end enlarges and divides into two short branches, by the anterior of which it is continued as a cartilaginous band to the cranium. The upper end of this band is again ossified in the form of a curved cylindrical plug of bone, with a truncated lower extremity, lying in a groove on the side of the tympanic bone, the edges of which groove meet around it in adult animals, and often become ankylosed with it; but this is only a secondary connection. The primary connection is with the periotic or petro-mastoid bone, immediately in front and to the inner side of the stylo-mastoid foramen. In embryonic specimens it can be traced as a distinct band of cartilage lying to the anterior and inner side of the lower end of the Fallopian aqueduct, and passing to the upper and back part of the tympanic cavity, near to the spot from which the stapedius muscle takes origin. This is then the true proximal extremity of the anterior arch of the hyoidian apparatus, if we leave out of consideration the stapedius and incus which there is reason to believe are developed from the same rod of cartilage—a question which is not discussed in the present communication. Whatever may be the case with regard to the origin of the last-named parts, it is a subject of easy demonstration that in the sheep there is an ossified portion of the upper end of the hyoid arch, above and distinct from the stylo-hyal, which becomes firmly united with the periotic, and which may ossify either from a separate centre or by extension of bone from the periotic. Whether it should be considered as a process of the periotic or as a separate element may still be a matter of opinion; but the existence of such a part as a distinct portion of the hyoid arch requires recognition. It may be conveniently distinguished by the name of *tympano-hyal*, as it is always in relation with the tympanic bone, and continues the hyoid arch up to the wall of the cavity of the tympanum.

This portion of the skull can be distinctly recognised at the spot indicated (*i.e.* to the anterior and inner side of the stylo-mastoid foramen) in almost all mammals, though in very different degrees of development, usually in accordance with the size and amount of ossification of the remainder of the anterior arch. Thus, in those of the Ungulata, as the ruminants, and especially the horse and rhinoceros, in which the stylo-hyal is very largely developed, the tympano-hyal is most conspicuous, but where, as in the pig, the anterior arch is little ossified, the tympano-hyal is comparatively rudimentary. In the cetacea it is quite distinct, though small, and a fine band of cartilage can often be traced from the upper end of the stylo-hyal into it, embedded in the great ligamentous mass which attaches that bone to the exoccipital and surrounding parts of the cranium, and which of course is only a secondary connection.

In man, this bone or process is also quite distinct, although it seems to have been generally confounded with the stylo-hyal. The so-called styloid process of the temporal bone has long been known to have a separate centre of ossification, and is also generally recognised as the homologue of the stylo-hyal of other mammals, one of the main points of difference being, that whereas in all others it is an independent bone not connected directly with the cranium, in man it is always ankylosed to the "temporal," or forms a process of the skull.

If a human skull at the period of birth is examined, a very small round piece of bone surrounded by a deep groove can be seen exactly where the tympano-hyal is found in the sheep, just behind the posterior limb of the inverted arch formed by the tympanic bone, and in front and to the inner side of the stylo-mastoid foramen. This increases somewhat in size as age advances, forming a distinct process, supported, and partly embraced in front by the vaginal process of the tympanic. The true styloid or stylo-hyal at birth is a slender rod of cartilage, often partially ossified in the centre, and invested by a strong fibrous sheath, from which the stylo-hyoid, stylo-glossus, and stylo-pharyngeus muscles take origin. Though it occasionally becomes ankylosed in the adult with the tympano-hyal, as is the case with those skulls which have very long styloid processes, this does not occur so frequently as is described in most works on anatomy. In the large majority of skulls, before middle age, the stylo-hyal is free, and is commonly lost in maceration. The short process which is always present, and which is commonly considered as a rudimentary styloid process, is really a distinct portion of the hyoid arch, corresponding with the tympano hyal of the sheep.

The communication was illustrated by specimens and diagrams.

On the Correspondence between the Anterior and Posterior Extremity, and the Modifications of the Position of the Limbs in the higher Vertebrata.—Professor W. H. Flower, F.R.S. This communication was chiefly devoted to an exposition, by means of specimens and diagrams, of the views held by most English anatomists of the serial homologies of the different bones of the extremities, founded upon comparison of the anterior, cephalic, or preaxial border of the one, in the primitive position, with the same border of the other, which leads to results opposed to the views of Wyman and other American anatomists, founded upon the principle of antero-posterior symmetry.

On Lefthandedness.—Dr. Pye-Smith. The author referred to the prevalence of this condition as an occasional variety as far back as tradition goes, and in various parts of the world. Like righthandedness, it should be regarded as a functional specialisation, not a structural transposition. That it does not depend on transposition of the viscera is proved by several cases; and also that it does not result from the abnormal origin of the subclavian artery, as referred to in a previous number of Nature. Righthandedness is probably the immediate result of some structural difference between the two cerebral hemispheres. Gratiolet's statement, that the left hemisphere is earlier developed, is con-

tradicted by Ecker, Vogt, and Callender; but Broca's, that it is normally heavier than the right, is confirmed by Dr. Boyd. The author then spoke of the possible truth of Brown-Séquard's theory of the left hemisphere presiding specially over animal, the right over organic functions. Normal aphasia with right hemiplegia was contrasted with cases cited from Dr. Ogle and Dr. Hughlings Jackson, of left-handed persons with left hemiplegia and aphasia. The primitive condition was probably one of perfect bilateral structural symmetry and ambidextrous function. The normal condition at present is the result of hereditarily transmitted specialisation of structure and functions, both the result of some advantage resulting to individuals using the right hand, eye, or foot, for the performance of more specialised functions than those of swimming, climbing, &c., such for instance as carrying weapons or nursing children. Lefthandedness would then be explained as a more or less complete reversion to an ancestral condition. Right and Lefthandedness should, therefore, be compared with such deviation in function and structure as is observed for instance in the cleiæ of the higher Crustacea, while transposition of viscera is to be classed with the reversed twist occasionally seen in the skull of *Pleuronectidæ* and the shells and entire bodies of Gasteropoda.

Professors Burdon Sanderson and S. Stricker read a paper on *A New Method of Studying the Capillary Circulation in Mammalia.* The circulation was studied in the omentum of a guinea-pig immersed in a solution of salt and water of a certain strength and temperature, the animal being thoroughly chloralised.

Contributions to the Migration Theory.—Richard Caton, M.D. This paper contained an account of a number of experiments on the capillary circulation of the frog, fish, and tadpole in reference to the interesting phenomenon of the migration of blood-corpuscles out of the vessels. The opinion was expressed that this occurrence was chiefly due to congestion, and also that there were grounds for considerable doubt as to whether it had any connection with the suppurative process, as hitherto supposed to be the case. This paper was read immediately after those of Dr. Burdon Sanderson and Prof. Stricker, and the three were discussed together.

On the Antiseptic Treatment of Contagia as Illustrative of the Germ Theory of Disease.—Mr. Hope. The author gave some valuable details as to his treatment of the rinderpest which broke out upon his experimental farm in Essex in 1867. The majority of between 260 and 270 cows were attacked by that disease. He injected carbolic acid through either the mouth or rectum, and 111 of those cows so treated recovered. The remainder not so dealt with died or had to be slaughtered. He also argued that the chemical instead of the medicinal treatment of contagion was much better both in respect to men and the lower animals. He also gave illustrative cases of scarlet fever, with the view of showing that the sipping of a very weak solution of carbolic acid, sprinkling body, clothes, carpets, &c., was highly beneficial in its effects.—Dr. Baylis, medical officer of health, Birkenhead, agreed with the reader in his views regarding rinderpest, but not entirely with his treatment of fever. He (Dr. Baylis), speaking of the unsatisfactory manner in which that subject was treated by the British Association, expressed a hope that before next year's meeting they would institute some experiments as to the action of disinfectants.

Department of Ethnology and Anthropology

Dr. King read a paper *On Blight in Man, and the Animal and the Vegetable World.* Having defined the terms blight, contagion, and infection, the author proceeded to describe the signs by which their presence could be traced, and enumerated the various diseases which were supposed to be contagious or infectious, referring incidentally to small-pox, which could not, in his opinion, be averted by vaccination. He thought that disease was the result of a local impurity of the atmosphere, and that whereas a healthy person might be affected if he went to the locally impure spot, the party suffering could not convey it to another upon his removal to a different locality.

Dr. Hitchman read a paper on the *Anatomy of Intellect*, detailing numerous physiological experiments in regard to the nature of life and mind in man and animals. Mental phenomena, he maintained, did not always imply the existence of brain, or cephalic ganglia, or of nerves conveying impressions to cerebral organisation at all. Mind is not invariably dependent upon a molecular condition of brain—this organ being often sound in acute and chronic cases of insanity, the seat of disease being found, according to statistical observation, at home and abroad, in the alimentary canal, liver, uterus, spleen, heart, and lungs, in at least a moiety of all cases. This is true, even in the most severe mental affection known to the physician, paralytic dementia. The mental principle is not confined to brain molecules, but is equally contained in parts far distant from them, and is separable from the body, as mind, in a latent state, as well as an immaterial new individual. The whole mental organisation is specially operant independently of all molecular changes in ganglious and nervous cords, though the psychical mode of action is largely determined in the genus *homo* and higher forms of animal nature, by the modification of structure and physiological condition of each anatomical organ; both healthy and morbid changes show there is a certain point in the physical history of instinct and intelligence, at once and for ever fatal to the doctrine of Professor Tyndall, and other physicists, viz., that thought, sense, emotion, nay, every fact of consciousness, are due exclusively to molecular motions of brain.

On the Relation of the ancient Moabites to neighbouring Nations, as disclosed in the newly discovered Moabite Stone.—Rev. Dr. Ginsburgh. This stone was found as recently as the year 1868, during researches in Palestine; the inscription occupied 34 lines, and was written in a language which traced its origin to a date long prior to the Christian era. The translation looked like a chapter of the Bible; and when it was borne in mind that of 15 cities mentioned in the Old Testament, 11 were referred to on the stone, no one could doubt that the Moabites were in a far greater state of civilisation than was generally supposed. The inscription dated back as far as 900 years before Christ, and was, therefore, older than two-thirds of the Old Testament. As the result of careful study, he came to the conclusion that an organised Temple service was observed amongst the Jews out of Palestine, and that that service must have been very much akin to the service of the Moabites; that at a period 900 years before Christ, the word "Jehovah"—although subsequently avoided with so much persistency—was so often upon the lips of the Hebrew race, that it passed over to a neighbouring nation; that the simplicity of the language was a striking evidence of the advanced stage of civilisation of the Moabites, and that in prowess they were superior to the Jews.

The following papers were read relating to the Australians, their language, and mental characteristics. The first paper was by Mr. C. S. Wake, and was entitled, *The Physical Characteristics of the Australian Aborigines;* the second was sent by Dr. Bleek, and was on *The Position of Australian Languages.* The author traced certain analogies between the several Australian languages, placing them all in Max Müller's great nomadic or Turanian class; and although the Australians have, with few exceptions, no grammatical distinctions of gender, the author does not think that this necessarily excludes them from the sex-denoting family. The use of suffixes in the Australian languages led him to infer that they have been derived from the more temperate zones. Indeed, the nations using suffix-pronominal languages are found on the outskirts of the tropics, and in temperate and cold latitudes, while those speaking prefix-pronominal tongues are restricted to the tropics; and again, the suffix-pronominal class are addicted to sidereal worship, and the prefix-pronominal to ancestor worship. The author, however, carefully showed that the physical descent of a race by no means necessarily coincides with the descent of its language; and, in conclusion, the learned doctor expressed his belief, based on a study of the mythology and the present customs of the Australians, that these have degenerated from a higher state of civilisation. The third and concluding paper in this series was by Mr. C. S. Wake, and was on *The Mental Characteristics of the Australian Aborigines.*

SECTION G.—MECHANICAL SCIENCE

Rolling or Shaping Axles.—Mr. Alfred Bowater. This paper embraced a description of a new machine, existing in model, for the shaping of railway axles by rolling pressure. Whereas by the method of using the steam hammer an axle required half an hour in shaping this rolling process would effect it in a superior manner in two minutes. The rolled axle was not only superior in quality, but was more uniform in size, and could be produced much more cheaply. The machine consisted of three rollers, which were regulated so that they might gradually press closer together, thus reducing the diameter of the bar and extending

its length until shaped to the size required. Axles of any length could be rolled by the machine, with collars at any part of the tyre. The rollers were geared to revolve all in the same direction, and their friction imparted motion to the axle. The rolling process would obviate those flaws in axles which occasionally caused appalling accidents on railways.

On a New Safety Lamp.—Mr. W. E. Teale. After detailing a number of the objectionable features of the various safety lamps now in use, the author proceeded to say that, with a view to remedy so far as possible the dangers arising from the insecurity of the present oil lamps, the Protector Colliery Lamp has been carefully and thoughtfully designed to combine safety and brilliancy of light with cleanliness and economy. It is made on the principle of the ordinary sponge or portable gas lamp, in which is used a liquid specially prepared by the inventors. The reservoir, or gas-holder, is then screwed to the top of an ordinary Stephenson or Clanny lamp, within which are fixed a pair of horizontal hinges, moving upwards only. On the wick tube of the lamp, and sliding over it, is an outer tube, having round its centre a circular horizontal flange. When the reservoir is screwed upwards into the top, this flange comes into contact with the hinges, raises them in passing, and allows them to fall beneath it when screwed home, so that by reversing the screw, and withdrawing the reservoir gradually from the top, the said hinges prevent the return of the said sliding tube, thereby forcing it over the wick-tube, and so diminishing, and ultimately extinguishing the light. It is therefore impossible for a naked light to become exposed after the lamp has once been adjusted. To render security doubly sure, a lock and stop are so placed that after the light is put out by the action of the screw, it is still impossible for the collier to withdraw the reservoir from the top, so as to re-light his lamp. The safety of the mine is further insured by the fact that the gauze is kept perfectly clean, and therefore no coal-dust can adhere to it, as in the old oil lamps. In regulating and reducing the light when testing for gas, which can be done with the greatest ease and certainty, no pricker is used or required, and another source of danger is avoided. This lamp burns freely with less ventilation than any now in use, and is much more sensitive to the presence or action of gas, while it is impossible for the miner to light his pipe from, or tamper with, the light in any manner. It gives much more light than that produced by the very finest oil; and as neither smoke nor soot is made by combustion, the glass and gauze are as clean and the light as good at the end of the day as when the miner goes down the pit, and this without the trouble and great loss of time necessary to keep an oil lamp properly trimmed. As compared with oil, the cost of burning the Protector Colliery Lamp is very small, six days of ten hours each, or sixty hours, being obtained at a cost of threepence, or less than one half the price of ordinary miners' candles, and one-third that of the usual oil.

On Ocean Telegraphy.—Captain Rowett. The object aimed at in his paper by Captain Rowett was to show the superiority of hemp over metallic cables. The author contended that hemp cables were much lighter and extremely enduring when submerged, and iron cables were quickly corroded by the action of the sea water. Various specimens of submerged cable were exhibited by the author in support of his views.

SCIENTIFIC SERIALS

Journal of the Chemical Society, September, 1870.—This number only contains two papers; the first, on Vapour Densities, by Mr. J. T. Brown, contains a short description of the methods that have been proposed for their determination, and the formulæ employed for calculating the results from the data obtained. This serves as an introduction to a series of elaborate tables intended to facilitate these complicated calculations. The tables are a sequel to some previously published by Mr. Brown (*Journ. Chem. Soc.* N.S. iv. 72), and it might be acceptable to many chemists if the author would collect these and other tables and publish them in a separate pamphlet. The other paper is an abstract of a memoir in the Philosophical Transactions for 1869, entitled "Researches on Vanadium," by Professor Roscoe. The author has obtained three vanadium chlorides, a tetrachloride V Cl_4, a trichloride V Cl_3, and a dichloride V Cl_2. The tetrachloride may be prepared by passing dry chlorine over the mononitride heated to redness, or by transmitting a mixture of chlorine and the vapour of vanadyl trichloride V O Cl_3 over red-hot sugar-charcoal. Its vapour density corresponds to the formula V Cl_4. The trichloride is a crystalline peach-blossom coloured compound, resembling chromium sesquichloride. It is not volatile in hydrogen, but when strongly heated in this gas it loses chlorine, the dichloride and finally the metal being obtained. It is produced by heating the tetrachloride, or by its slow decomposition at the ordinary temperature, or by passing its vapour with hydrogen through a red-hot tube. Vanadium dichloride is an apple-green crystalline body, prepared by transmitting the vapour of the tetrachloride with hydrogen through a tube heated to dull redness. The dichloride, when heated in hydrogen in a platinum boat, yields the metal in bright, greyish-white lustrous grains. The processes hitherto described for the preparation of the metal have been tried by the author without success. The chloride or nitride is placed in a platinum boat and heated in a porcelain tube, through which a current of pure hydrogen passes. The metal does not tarnish in the air at common temperatures, but burns with brilliant scintillations when thrown into a flame. When heated in air it oxidises, producing all the oxides V_2O, V_2O_3, V_2O_3, V_2O_4, and V_2O_5. It is not attacked by hydrochloric acid or dilute sulphuric acid. Hot strong sulphuric acid slowly dissolves it. It is violently oxidised by nitric acid, and slowly dissolved by hydrofluoric. The metal burns in chlorine, and when heated in nitrogen forms the mononitride.

DIARY

THURSDAY, NOVEMBER 3.

LINNEAN SOCIETY, at 8.—On the Fertilisation of Orchids and Asclepiads: Dr. Mansel Weale.—On a Solitary Bee from South Africa: Dr. Mansel Weale.

CHEMICAL SOCIETY, at 8.—On the Analysis of Cast-iron: Mr. A. H. Elliott.

MONDAY, NOVEMBER 7.

ROYAL INSTITUTION, at 2.—General Monthly Meeting.

LONDON INSTITUTION, at 4.—Chemistry: Prof. Odling.

TUESDAY, NOVEMBER 8.

ETHNOLOGICAL SOCIETY, at 8.—On the Kimmerian and Atlantean Races: Mr. Hector McLean.—Note on the name "Aymara": Mr. C. R. Markham.—Reply to Mr. Markham's Note by Mr. David Forbes.

WEDNESDAY, NOVEMBER 9.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Notes on the Minute Structure of certain Insect Scales: Mr. S. J. M'Intire

THURSDAY, NOVEMBER 10.

LONDON MATHEMATICAL SOCIETY, at 8.—General Meeting. Retiring President's Address. Sketch of recent researches upon quartic and quintic surfaces.

BOOKS RECEIVED

ENGLISH.—The Elements of Mechanism: T. M. Goodeve (Longmans).—Papers on the Great Pyramid: J. V. Day (Edmonston and Douglas).

FOREIGN.—(Through Williams and Norgate)—Jahrbuch der Empfindungen: Hirzel und Gretschel.—Geometrische See-proben: Dr. Boetcher.—Ueber die Entwicklung und Verwendung der Wärme: P. Tunner.—Archiv für Ophthalmologie: Arlt, Donders, und von Graeffe.—Jahresbericht über die Fortschritte der Chemie.

CONTENTS

ERRATA.—Vol. ii., page 399, second column, line 18 from bottom, for "Electrometer" read "Anemometer." Page 512, second column, line 7 from bottom, for "requirements" read "acquirements."